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What is Technology

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ARTICLE

WHAT IS "TECHNOLOGY"?

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ABSTRACT

Patent protection is limited to "technology," but technology is so difficult to define that the Supreme Court has taken up the issue several times in the last several years. The Supreme Court's recent decisions in *Bilski*, *Prometheus*, and *Myriad* have left patentable subject matter doctrine just as confused as ever, however. What is patentable technology?

The answer turns out to have nothing to do with the various pragmatic rationales that courts commonly cite. Rather, the patent system has defined patentable technology according to much simpler criteria – artifice and action. Artifice is the quality of being created by humans, not by nature. Action is the quality of behaving or operating in some active way. Together, artifice plus action explain and, perhaps more importantly, unify the law on patentable subject matter. By focusing on artifice plus action as the primary criteria defining patentable technology, the patent system can provide clearer guidelines than it has been able to achieve thus far.

INTRODUCTION

In the last several years, the Supreme Court has taken on an unusually large number of patent law cases, a testament to the growing importance of patents in the modern economy. The patent system is designed to encourage the

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"useful Arts" – or what modern language would refer to as the "technological arts." New technologies can cost thousands or even millions of dollars to develop, but patents on those technologies can be worth millions or even billions of dollars. Whether any particular technological innovation qualifies as patentable subject matter therefore can be critical in deciding whether to invest in its research and development. An ideal patent system would most efficiently promote and protect such investments in new technologies by making clear what subject matter is eligible for patent protection.

Patentable subject matter is a confusing area of law in need of clarity. Despite its long history, the U.S. patent system has never been able to provide a precise definition of what "technology" means within the context of patent law. The existing broad categories of included and excluded subject matter are vague, and the rationales and tests proffered thus far for distinguishing between the two have resulted only in further confusion. The Supreme Court itself has revisited the subject of patentable subject matter at least three times in as many years, but to little avail.[1] Patentable subject matter has proven so messy that some commentators go so far as to call for an end to the inquiry altogether, suggesting instead that we rely on other patentability requirements, such as utility and novelty, to distinguish patentable from unpatentable technology.[2]

Nonetheless, within the courts' repeated attempts to define technology are two surprisingly consistent concepts that characterize all patentable subject matter – the concepts of artifice and action. All patentable subject matter displays some threshold degree of artifice, roughly defined as perceived degree of alteration through human intervention. Likewise, all patentable subject matter must also display at least a threshold degree of action, roughly defined as new operation or activity through human intervention. Together, artifice and action explain and, perhaps more importantly, unify the law on patentable subject matter.

Explicitly adopting artifice and action as the standard for patentable technology offers a number of benefits. The artifice-plus-action standard allows patent law to move away from wrangling over what an "abstract idea" or "process" is or from deciding whether an invention is truly a machine or just cleverly claimed as such.

Moreover, applying artifice plus action as a standard takes into account the fact that both artifice and action exist as continuous characteristics lying along a spectrum. Acknowledging the scalar quality of both artifice and action allows

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[1] Ass'n for Molecular Pathology v. Myriad Genetics, Inc. (*Myriad II*), 133 S. Ct. 2107 (2013); Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289 (2012); Bilski v. Kappos, 130 S. Ct. 3218, 3225 (2010).

[2] Kristen Osenga, *Ants, Elephant Guns, and Statutory Subject Matter*, 39 ARIZ. ST. L.J. 1087 (2007); Michael Risch, *Everything Is Patentable*, 75 TENN. L. REV. 591 (2007); David Kappos, USPTO, *Some Thoughts on Patentability* (July 27, 2012, 2:09 PM), http://www.uspto.gov/blog/director/entry/some_thoughts_on_patentability.

the patent system to adapt to new technologies without resorting to the kinds of efforts as bright-line rules that have led patentable subject matter doctrine astray.

Finally, by directly adopting an artifice-plus-action standard, perhaps patent law can achieve a more transparent and therefore more predictable definition of patentable subject matter without abandoning decades of existing case law or the expectation interests that case law has engendered.

This is not to say that an artifice-plus-action standard would solve all of patentable subject matter's problems. Standards themselves are often vague, and an artifice-plus-action standard would require courts to make many judgment calls about where along the spectrum of artifice and action any given invention must fall before it can be considered patentable technology. Such line-drawing is a characteristic of many concepts in patent law, however, and is a task in which the courts have had to develop some competence.[3]

An artifice-plus-action standard also cannot guarantee the "right answers" in terms of what would most efficiently "promote progress in useful Arts." How best to draw the bounds of patentable subject matter to incentivize innovation is a difficult and perhaps unanswerable question. Adopting as clear and consistent an approach as possible is often more important than getting the "right answer," as clarity and predictability are at least as important as any other practical concern in the efficient administration of the patent system.

Section I of this Article introduces the problems of how patentable subject matter has been defined thus far, and Section II introduces the concepts of artifice and action and explains how artifice plus action consistently define the patent system's interpretation of both the statutorily included and judicially excluded categories of subject matter. Section III then applies the artifice-plus-action standard to some of the trickier areas of patentable subject matter, such as business methods, diagnostic methods, genetic material, and computer software. This Section also discusses some of the potential costs of using artifice plus action as a standard for patentable subject matter but argues that the benefits likely outweigh these costs.

THE PROBLEM OF PATENTABLE SUBJECT MATTER

Courts generally describe patentable subject matter restrictions as a threshold limitation on what may be granted patent protection.[4] Patents rights are in many ways property-like entitlements. Like property rights, a patent provides the right to exclude; that right is to exclude all others from making, using, selling, or offering to sell the patented invention for a limited period of

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[3] *See infra* notes 279-286 and accompanying text.

[4] *Bilski,* 130 S. Ct. at 3225; David S. Olson, *Taking the Utilitarian Basis for Patent Law Seriously: The Case for Restricting Patentable Subject Matter*, 82 TEMP. L. REV. 181, 184 (2009); Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1042, 1043 (1990).

time. Patents in turn help to incentivize investments in developing patentable inventions by excluding others from potentially free-riding on that investment.[5]

To define what a patent is, however, does not define what subject matter a patent may cover. Article I, Section 8 of the Constitution authorizes Congress to implement a patent system "[t]o promote the Progress of . . . useful Arts."[6] At the time of drafting, the term "useful Arts" referred to the mechanical, industrial, and manual arts,[7] or what in modern English are the technological arts.[8]

Unfortunately, simply translating "useful Arts" into its modern-day synonym has provided little clarity. Although most of us have an intuitive sense of what technology is, articulating that sense in a rigorous manner that can be applied in a court of law is extremely difficult. As the Federal Circuit[9] noted in its recent decision in *In re Bilski*, "technology" and "technological arts" are ambiguous terms that can change with context.[10] As the United States Patent & Trademark Office ("PTO") once explained, "[A]ny attempts to define what is 'in the technological arts' raises more questions tha[n] it appears to answer."[11] Despite its predecessor court's brief flirtation with looking at whether an invention was within the "technological arts" as a patentable subject matter standard,[12] the Federal Circuit ultimately rejected the

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[5] Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247 (1994); Olson, *supra* note 4, at 192-93.

[6] U.S. CONST. art. I, § 8.

[7] Robert I. Coulter, *The Field of the Statutory Useful Arts*, 34 J. PAT. OFF. SOC'Y 487, 496 (1952); Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 50-55 (1949-1950); *see generally* Edward C. Walterscheid, *To Promote the Progress of Science and Useful Arts: The Background and Origin of the Intellectual Property Clause of the United States Constitution*, 2 J. INTELL. PROP. L. 1 (1994).

[8] *See, e.g.*, *Bilski*, 130 S. Ct. at 3244 (Stevens, J., concurring); *In re* Comiskey, 554 F.3d 967, 976-77 (Fed. Cir. 2009); Paulik v. Rizkalla, 760 F.2d 1270, 1276 (Fed. Cir. 1985) (en banc); *In re* Bergy, 596 F.2d 952, 958 (C.C.P.A. 1979) (vacated on other grounds); *In re* Musgrave, 431 F.2d 882, 893 (C.C.P.A. 1970); *see also* Alan L. Durham, *"Useful Arts" in the Information Age*, 1999 B.Y.U.L. REV. 1419, 1419-20, 1419-1420; Lutz, *supra* note 7, at 54.

[9] Founded in 1982 as the successor to the Court of Claims and Patent Appeals, the Court of Appeals for the Federal Circuit has exclusive appellate jurisdiction over cases "relating to patents." 28 U.S.C. § 1295 (2012).

[10] *In re* Bilski, 545 F.3d 943, 960 (Fed. Cir. 2008). For convenience, however, the following discussion refers to "patentable technology" not as a criterion for identifying patentable subject matter, but as synonymous with "useful Arts."

[11] *Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility*, 1300 OFFICIAL GAZ. PAT. & TRADEMARK OFF. 1, 44 (Oct. 26, 2005), *available at* http://www.uspto.gov/web/offices/pac/dapp/opla/preognotice/guidelines101_20051026.pdf.

[12] *In re* Benson, 441 F.2d 682 (C.C.P.A. 1971); *Musgrave*, 431 F.2d at 893.

technological-arts test as unworkably vague.[13]

Both the Patent Act and judicial precedent therefore have interpreted the Constitution's reference to the "useful Arts" as categories of inclusion and categories of exclusion. Section 101 of the Patent Act states that patents may cover "any new and useful process, machine, manufacture, or composition of matter."[14] The Patent Act fails to define "process, machine, manufacture, or composition of matter" with any specificity, however. Courts have instead interpreted Section 101 largely by negative implication, stating that patentable subject matter does *not* include "laws of nature," "phenomena of nature" (also referred to as "physical phenomena"), and "abstract ideas,"[15] categories that are themselves frustratingly vague.[16] The courts seldom attempt to define each category or even specify into which category a patentable invention falls, focusing instead on the more general question of whether the invention is patentable subject matter *vel non*.[17]

But that still leaves the question: what is patentable subject matter? What is technology? As argued elsewhere, courts' approaches to patentable subject matter turn out to be mostly intuitive – that is, patentable subject matter based not so much on economic rationales or even judicial precedent as it is on an underlying instinct about what constitutes technology.[18] This Article takes that analysis a step further to point out that the instinct behind patentable subject matter can be distilled into two specific themes: artifice and action.

Specifically, patentable technology must be the product of human-mediated changes, or what the analysis below refers to as "artifice." Artifice alone is not sufficient, however; patentable technology cannot merely exist but must instead be given some new action or operation, a quality the analysis below refers to simply as "action." The following Section introduces the concepts of artifice and action in more detail.

THE THEMES OF ARTIFICE AND ACTION

Artifice and action are strong motivating currents throughout patentable subject matter discussions and are themes often touched upon in case law and commentary. Although the concepts of artifice and action will likely sound

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[13] *In re Bilski*, 545 F.3d at 1015.

[14] 35 U. S. C. § 101(2011).

[15] *See, e.g.*, Bilski v. Kappos, 130 S. Ct. 3218, 3221 (2010) (citing Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980)) (stating that there are three categories of exclusion). These common-law exceptions reputedly date back at least 150 years. *Id.* at 3221 (citing Le Roy v. Tatham, 55 U.S. 156 (1853)).

[16] Diamond v. Diehr, 450 U.S. 175, 219 (1981) (Stevens, J., dissenting).

[17] *In re* Nuijten, 500 F.3d 1346, 1362 (Fed. Cir. 2007) (Linn, J., dissenting); Risch, *supra* note 2, at 658.

[18] *See generally* Emily Michiko Morris, *Intuitive Patenting* (unpublished manuscript) (on file with author).

familiar,[19] the case law on patentable subject matter seldom mentions artifice and action explicitly. Part II.A. therefore provides general definitions for artifice and action to introduce how these concepts are used in this Article. Part II.B. then provides proof of the artifice and action concepts and more rigorous explanations of each.

Artifice and Action Defined

Artifice

The concept of "artifice" is an easily recognizable motif in patentable subject matter.[20] Patent law prohibits patents on naturally occurring phenomena and laws of nature; as the Supreme Court stated, statutory subject matter is instead limited to inventions that are "human-made" and "a product of human ingenuity."[21] Patentable subject matter thus includes only that which is a "non-naturally occurring manufacture or composition," – something other than a spontaneously arising phenomenon – that possesses "markedly different characteristics from any found in nature."[22]

The term "artifice" captures this quality nicely. Artifice refers to the products of human skill, as opposed to naturally occurring products;[23] its cognate adjectival form, "artificial," is similarly defined as anything humanly contrived, human-made, caused, or produced by a human and therefore "lacking in natural or spontaneous quality."[24] Along the same vein, artifice refers to the art, skill, and ingenuity necessary to create human-made artifacts, qualities commonly associated with patentable technology.[25] Artifice also derives from the constitutional mandate that patents be granted to "useful *Arts*," for "art" refers to "the exercise of human skill, as distinguished from

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[19] *See generally* Daniel J. Klein, *The Integrity of Section 101: A "New and Useful" Test for Patentable Subject Matter*, 93 J. PAT. & TRADEMARK OFF. SOC'Y 287 (2011).

[20] *See, e.g.*, Parker v. Flook, 437 U.S. 584, 592 (1978) (referring to this concept as "inventiveness"); John M. Conley & Robert Makowski, *Back to the Future: Rethinking the Product of Nature Doctrine as a Barrier to Biotechnology Patents*, 85 J. PAT. & TRADEMARK OFF. SOC'Y 301, 379 (2003) (noting "fairly consistent requirement that . . . a claimed invention with a natural precursor or variant must differ in some substantial and material way from the natural version"); Joshua D. Sarnoff, *Patent-Eligible Inventions After* Bilski*: History and Theory*, 63 HASTINGS L.J. 53, *passim* (2011) (referring to this concept as "creativity").

[21] Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980); Hartranft v. Wiegmann, 121 U.S. 609, 615 (1887).

[22] *Chakrabarty*, 447 U.S. at 309-10.

[23] *Artifice Definition*, SHORTER OXFORD ENGLISH DICTIONARY 124 (5th ed. 2002).

[24] *Artificial Definition*, MERRIAM WEBSTER, http://www.merriam-webster.com/dictionary/artificial (last visited April 29, 2013).

[25] *Artifice Definition,* DICTIONARY.COM, http://dictionary.reference.com/ browse/artifice (last visited April 29, 2013).

nature."[26] Inventions that display artifice therefore are new and distinguishable from phenomena that occur naturally, without human intervention. In this way artifice reflects Section 101's restriction of patentable subject matter to "*new* and useful" processes, machines, manufactures, and compositions of matter.[27]

Artifice requires more than human intervention alone, however. First of all, human activity and thought are not themselves "inventions" but rather means to invention. Technology is not the fact of human intervention but rather the subject matter affected or transformed by such human intervention. That is not to say that devices or even processes involving steps that could otherwise be performed by a human are unpatentable; as long as human-made elements perform some significant part of the overall function of the claimed invention, the invention may qualify as patentable subject matter.[28] Alleged inventions involving primarily human activity or thought itself, on the other hand, are generally unpatentable subject matter.[29]

Artifice is thus a scalar quality, and patentable artifice is a matter of degree.[30] The more the elements of an invention are changed from their naturally occurring forms, the more "artificial" and therefore patentable the invention will be. Inventions therefore lie along an entire spectrum of artifice, depending on how many naturally occurring elements they include and how much those elements have been altered from their natural state. At one end are inventions that clearly possess such "markedly different characteristics from any found in nature" that no analogous natural phenomenon can even be argued to exist.[31] Inventions at this end of the spectrum easily satisfy the artifice requirement. At the other end of the spectrum lie things so closely related to nature as to be almost indistinguishable; this latter group displays little or no patentable artifice at all. Most inventions range between the two extremes, but exactly where along that spectrum an invention displays adequate artifice is not easy to pinpoint.

At first glance, artifice might seem to overlap with patent law's novelty requirement. Artifice differs from novelty in several significant ways, however, and "new" within the meaning of Section 101 requires something different than novelty under Section 102.[32] Novelty, both in the previous Patent

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[26] *Art Definition,* DICTIONARY.COM, http://dictionary.reference.com/art?s=t (last visited April 29, 2013).

[27] 35 U.S.C. § 101 (2013).

[28] *See, e.g., In re* Comiskey, 554 F.3d 967, 979 (Fed. Cir. 2009); Alco Std. Corp. v. Tennessee Valley Auth., 808 F.2d 1490, 1496, (Fed. Cir. 1987).

[29] *See, e.g.*, Bilski v. Kappos, 130 S. Ct. 3218, 3226 (2010); *In re Comiskey*, 554 F.3d at 980.

[30] *See* Sarnoff, *supra* note 20, at 59-60 (referring to "degrees of creativity").

[31] Diamond v. Chakrabarty, 447 U.S. 303, 310 (1980).

[32] *See, e.g.*, Diamond v. Diehr, 450 U.S. 175, 189 (1981); Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 131 (1948); *see also* Rebecca S. Eisenberg, *Wisdom of the Ages or Dead-Hand Control? Patentable Subject Matter for Diagnostic Methods After* In re

Act and the new America Invents Act, looks only at whether others had previously made the claimed invention available to the public through "prior art" such as patents, printed publications, offers for sale, or public knowledge or use.[33] Artifice, by contrast, looks at whether the claimed invention previously existed at all. Newly identified laws of nature or phenomena of nature meet the novelty requirement if never previously identified in prior art. Laws and phenomena of nature by definition can never meet the artifice requirement, however, because they pre-exist human intervention and are not "made by man."

Although some judicial opinions might suggest otherwise, artifice should also not be confused with obviousness. Artifice is not a matter of the ingenuity or genius of the human intervention necessary to create an invention, nor is it a matter of how much experimentation or other intervention is necessary. Artifice is purely a matter of the degree of alteration or difference from naturally occurring phenomena.

Action

The other, somewhat less obvious motif running through patentable subject matter doctrine is "action." The patent system is often described as covering "functional" things that accomplish useful tasks.[34] Patentable subject matter requires more than just functionality and usefulness, however. Rather, patentability depends not just on whether an invention is useful but also on whether it is useful in a way cognizable under the Patent Act;[35] only "when [a claimed invention] is performing a function which the patent laws were designed to protect (e.g., transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of §101."[36]

What kind of function or utility are the patent laws designed to protect? Patent law has been notoriously vague on this point. This Article shows that the kind of function that qualifies for patent protection nonetheless has been fairly consistent. In order to qualify as technology, inventions must be actively

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Bilski, 3 CASE W. RESERVE J.L. TECH. & INTERNET 1, 54-55 (2012).

[33] 35 U.S.C. § 102(a), (e), (g) (novelty under the 1952 Patent Act revisions); 35 U.S.C. § 102(a) (2013), *amended by* Leahy-Smith America Invents Act, Pub.L. No. 112-29, § 3, 125 Stat. 284-341 (2011) (novelty under the America Invents Act).

[34] *See, e.g.*, Dan L. Burk, *Patenting Speech*, 79 TEX. L. REV. 99, 136 (2000); Vincent Chiappetta, *Patentability of Computer Software Instruction as an "Article of Manufacture:" Software as Such as the Right Stuff*, 17 J. MARSHALL J. COMPUTER & INFO. L. 89, 106 (1998); Dennis S. Karjala, *A Coherent Theory for the Copyright Protection of Computer Software and Recent Judicial Interpretations*, 66 U. CIN. L. REV. 53, 56 (1997).

[35] Dennis S. Karjala, *Distinguishing Patent and Copyright Subject Matter*, 35 CONN. L. REV. 439, 448-49 (2003).

[36] *Diehr*, 450 U.S. at 192; *accord* AT&T Corp. v. Excel Comm., Inc., 172 F.3d 1352, 1358-59 (Fed. Cir. 1999). Although the utility requirement also stems in part from the "new and useful" language of § 101, the Court here was referring to the patentable subject matter limitations of Section 101.

rather than passively useful; a patentable invention achieves its intended utility only by actively operating, behaving, performing, or otherwise acting in some manner. As the discussion below shows, a seldom recognized but implicit requirement for patentability is that a claimed invention should actively *do* something. Inert creations that passively exist display no patentable action.

The term "action" as used here reflects this quality of active operation. The dictionary defines "action" as a "process or state of being active," and "something done or performed."[37] Action is also synonymous with "operation" or "process[] or manner of functioning or operating; exertion of force, power, or influence; process of practical or mechanical nature in some form of work or production."[38] Both action and operation are thus related to the verb form of "function:" "to perform a specified action or activity; work; operate."[39]

Beyond synonyms, however, patentable action is difficult to define.[40] Patentable action takes an almost infinite variety of forms, much as the patent system must cover a wide variety of technologies. A few categories of functionality and use nonetheless clearly do not qualify as patentable action.

First, primarily informational or expressive works are unpatentably inactive.[41] This makes intuitive sense. While often quite useful, information and expression are not "self-executing" works and instead must be applied in order to create utility;[42] without such application, information and expression by themselves are functionally inert. Likewise, information on how to perform a function is unpatentable subject matter because mere instructions for human action do not themselves perform any activity.[43] Because information and expression can exist within the human consciousness, courts often characterize attempts to patent information or expression as effectively attempts to patent human thought, a category of excluded activity discussed below.

Outside of information *qua* information, however, courts seem somewhat less leery of allowing patents on inventions that involve information and even expression.[44] Courts have long considered inventions that convey, store, or display information or expression to be patentable subject matter, as long as

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[37] *Action Definition,* DICTIONARY.COM, http://dictionary.reference.com/browse/action?s=t (last visited Apr. 29, 2013).

[38] *Operation Definition*, DICTIONARY.COM, http://www.thefreedictionary.com/operation (last visited Nov. 28, 2013).

[39] *Function,* DICTIONARY.COM, http://dictionary.reference.com/browse/function?s=t (last visited Apr. 29, 2013).

[40] *Cf.* Emily Michiko Morris, *Res or Rules: Patents and the (Uncertain) Rules of the Game*, 18 MICH. TELECOMM. & TECH. L. REV. 481, 495-97 (2011) (noting difficulties of describing an invention's function with precision and clarity).

[41] *See* Karjala, *Distinguishing Patent, supra* note 35, at 448-49.

[42] *Id.* at 452.

[43] *Id.*

[44] Kevin Emerson Collins, *Claims to Information Qua Information and a Structural Theory of Section 101*, 4 J.L. & POL'Y I.S 11 (2008) (coining the phrase "information *qua* information").

their sole distinguishing characteristic is not the information or expression they carry, store, or display.[45] If a work is not specific information or expression itself but rather a means for displaying, conveying, or storing the information, the work is patentably active.

A second category of unpatentably inactive works covers those that are primarily human activity. In much the same way that the artifice requirement looks only at the object of human intervention and not at human intervention itself, action looks only at the operativity of that object and not at the human activity that created it. Again, human action is not itself technology but rather the means for creating technology. In this way action mirrors artifice's rejection of human thought and behavior.

Another area of overlap between action and artifice suggests a third category of useful but unpatentably inactive works: works that operate in the same way that they do in nature, not in a way created or at least influenced by human intervention.[46] The difference between naturally occurring and "artificial" action, so to speak, most often comes up when courts are trying to determine whether a work created through human intervention might nonetheless still be an unpatentable phenomena of nature.[47] How a claimed invention operates is thus important under both the action and artifice requirements.

Much like artifice, patentable action falls along a spectrum, and claimed inventions display varying degrees of action, depending on the elements involved.[48] Some elements of an invention are more patentably active than others,[49] such that the sum total is more or less "active" when the invention is viewed as a whole. Thus, for example, all patentable inventions involve some level of human activity and thought, if only in their creation, but the more human activity the invention entails to carry out its purpose, the less it satisfies either the artifice or action requirements.[50] Similarly, the more an invention

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[45] Karjala, *Distinguishing Patent, supra* note 35, at 448-49; *see also* Kevin Emerson Collins, *Semiotics 101: Taking the Printed Matter Doctrine Seriously*, 85 IND. L.J. 1379, 1433 (2010) (referring to patentable action as a "nonsemiotic" (non-information) property); *see also infra* text accompanying notes 184-193 (discussing the printed-matter doctrine).

[46] *Cf.* Linda J. Demaine & Aaron Xavier Fellmeth, *Reinventing the Double Helix: A Novel and Nonobvious Reconceptualization of the Biotechnology Patent*, 55 STAN. L. REV. 303, 338 (2002) (warning against "mistak[ing] utility for newness" in distinguishing patentable subject matter from products of nature).

[47] *E.g.*, Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 131 (1948).

[48] *See, e.g.*, Mayo Collaborative Servs. v. Prometheus Labs., 132 S.Ct. 1289, 1298-1300 (2012); Classen Immunotherapies, Inc. v. Biogen IDEC, 659 F.3d 1057, 1065 (Fed. Cir. 2011) (quoting *In re* Prater, 415 F.2d 1393, 1402 n.22 (C.C.P.A. 1969)); Research Corp. Techs., Inc. v. Microsoft Corp., 627 F.3d 859, 868 (Fed. Cir. 2010); *see also* Lloyd L. Weinreb, *Copyright for Functional Expression*, 111 HARV. L. REV. 1149, 1178 (1998).

[49] 1 WILLIAM CALLYHAN ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS 343 (1890) (describing patentable inventions as combinations of elements "each performing its own function by its own peculiar mode of operation").

[50] *See, e.g.*, Bilski v. Kappos, 130 S. Ct. 3218, 3226 (2010) ("Concerns about attempts to

entails and depends on patentable action to carry out its purpose, the more patentable the invention is likely to be.

The concept of action thus differs from utility and in fact requires something more than utility. To be sure, the function or action of an invention is an important factor under the utility requirement for patentability.[51] The utility requirement is not a stringent one, however; as long as an invention has an identifiably specific and substantial purpose and actually works for that purpose, the invention satisfies the utility requirement.[52] Many inventive ideas are thus patentably useful, but for some, "their utility is too far removed from what is claimed" to be patentable subject matter.[53] Only if an invention, "considered as a whole, is performing a function which the patent laws were designed to protect (e.g., transforming or reducing an article to a different state or thing), then the claim satisfies the [subject matter] requirements of § 101."[54]

The following Part demonstrates how artifice and action both explain and reconcile patentable subject matter doctrine and decisions.

The Proof: Patentable Subject Matter as Artifice and Action

Artifice and action may sound intuitively appealing as general descriptions of patentable subject matter, but do they explain patentable subject matter? Or are they the result of other, more determinative factors? Neither the Patent Act nor the courts cite artifice and action as the motivating impetus behind patentable subject matter, instead citing the assumed economic rationales driving patent law more generally.[55] In reality, however, these oft-cited pragmatic explanations for patentable subject matter have little or no explanatory power.

The combination of artifice and action, by contrast, does not necessarily reflect the most efficient way to draw patentable subject matter boundaries, but it at least explains and reconciles much of what is otherwise a haphazard jumble of doctrine that has long characterized the case law. Although

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call any form of human activity a 'process' can be met by making sure the claim meets the requirements of §101."); *accord In re* Bilski, 545 F.3d 943, 972 (Fed. Cir. 2008) (en banc) (Dyk, J., concurring).

[51] 35 U.S.C. §§ 101, 112 (2013); *see also* Utility Examination Guidelines, 66 Fed. Reg. 1092 (Jan. 5, 2001).

[52] Utility Examination Guidelines, *supra* note 51; Brooktree Corp. v. Advanced Micro Devices, Inc., 977 F.2d 1555, 1571 (Fed. Cir. 1992); Fuller v. Berger, 120 F. 274, 275 (7th Cir. 1903).

[53] *In re* Nuijten, 500 F.3d 1346, 1365 (Fed. Cir. 2007); *accord* Chiappetta, *supra* note 34, at 106 n.71; Eisenberg, *supra* note 32 at 10.

[54] Diamond v. Diehr, 450 U.S. 175, 192 (1981); *accord* AT&T Corp. v. Excel Comm. Mktg., Inc., 172 F.3d 1352, 1358-59).

[55] Lab. Corp. v. Metabolite Labs., Inc., 548 U.S. 124, 126-27 (2006) (Breyer, J., dissenting); *see* Gottschalk v. Benson, 409 U.S. 63, 67-68 (1972); *see also generally* Allen K. Yu, *Within Subject Matter Eligibility – A Disease and a Cure*, 84 S. CAL. L. REV. 387 (2011) (questioning whether current doctrine truly promotes progress).

patentable subject matter restrictions must comb through an ever-changing array of claimed inventions, artifice and action are the two constants that unify this diverse area of law.

The judicial categories of excluded subject matter and the statutory categories of included subject matter are perfect examples of how artifice and action define patentable subject matter.

Phenomena of Nature

Phenomena (or "products") of nature are a perfect example of how artifice and action distinguish patentable from unpatentable subject matter. Although case law does not explicitly define this category of unpatentable subject matter, phenomena of nature, as the name would suggest, are any naturally occurring forces, mechanisms, or materials. Phenomena of nature exist without human aid or intervention and thus by definition lack artifice.

In this way artifice reflects the distinction between "discoveries" and "inventions," a distinction courts often use to explain why phenomena of nature are unpatentable. Even if previously unknown or unappreciated and therefore "new" in some sense, phenomena of nature are already existing phenomena that can only be discovered, not invented. Inventions, on the other hand, are truly new creations that, without human intervention, would not exist. Only inventions – that is, the products of artifice, not nature – are patentable; mere discoveries are not.[56] As the Supreme Court explained in *Chakrabarty*, the relevant distinction for purposes of Section101 is "between products of nature . . . and human-made inventions."[57]

Phenomena of nature are distinguishable from patentable technology for more than just lack of artifice, however. Natural phenomena are neither inactive nor inert, but without human intervention, phenomena of nature do not act or function in any way that is "new" or acquire any new use.[58] Rather, natural phenomena bacteria perform in their natural way to their natural effect and thus merely "serve the ends nature originally provided and act quite independently of any effort of the patentee."[59] Natural phenomena thus fail the action requirement because they lack the kind of humanly created functionality characteristic of patentable technology.

What is even more important in distinguishing patentable technology from phenomena of nature is the fact that both artifice and action are scalar qualities.

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[56] *See, e.g.*, Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1293 (2012); Bilski v. Kappos, 130 S. Ct. 3218, 3230 (2010); Parker v. Flook, 437 U.S. 584, 591-92 (1978); *see also* Sarnoff, *supra* note 20, *passim*.

[57] Diamond v. Chakrabarty, 447 U.S. 303, 313 (1980).

[58] Natural phenomena are active and function in a variety of naturally occurring ways, such as metabolizing and producing, conducting electricity, absorbing moisture, combusting, transmitting mechanical energy, oxidizing, and reducing.

[59] Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 131 (1948); *accord Chakrabarty*, 447 U.S. at 310; Hartranft v. Wiegmann, 121 U.S. 609, 615 (1887).

Technology must not only differ in form and function from naturally occurring phenomena but must also display such "markedly different characteristics from any found in nature" so as clearly to constitute "a product of human ingenuity."[60]

To understand the scalar nature of patentable artifice and action, compare the Supreme Court's 1948 decision in *Funk Brothers Seed Co. v. Kalo Inoculant Co.* with the Court's decision in *Diamond v. Chakrabarty*. Although based on ostensibly similar facts, these decisions came to very different conclusions that can be explained only by acknowledging action as a requirement for patentable subject matter.

In *Funk Bros.*, the Supreme Court invalidated a patent on a mixture of root nodule bacteria used to help leguminous crops fix nitrogen from the soil.[61] Prior to the invention, farmers had to buy separate species of bacteria because no single species would work with all legume varieties, and if the farmers mixed several species together, the bacteria would inhibit one another. Bond discovered that certain strains of each species could be combined into a single inoculant without inhibiting one another. By mixing these select strains into a single inoculant, Bond's invention saved farmers from having to buy and work with multiple inoculants and saved manufacturers from having to make and stock multiple inoculants. Bond's inoculant clearly promoted the progress of the agricultural arts.[62]

Although the Court agreed that Bond's work was "ingenious" and "an important commercial advance," the Court rejected the claim as an unpatentable phenomenon of nature.[63] It was Bond's research into the non-inhibitory qualities of certain Rhizobium strains that was "ingenious," but this was merely a "discovery" of naturally occurring characteristics, not an invention. How Bond applied that discovery in creating a mixture of these species, on the other hand, was "hardly more than an advance in the packaging," according to the Court.[64]

Thirty years later, however, the Supreme Court found the bacteria in *Diamond v. Chakrabarty* to be patentable subject matter, unlike the bacteria in *Funk Bros.* Chakrabarty's claimed invention combined four naturally occurring plasmid genes into a single *Pseudomonas* bacterium that could digest crude oil spills. Prior to Chakrabarty's work, multiple bacterial species had to be used to clean oil spills, but Chakrabarty's invention streamlined oil spill clean-up by allowing the use of a single bacterial species.[65]Although Chakrabarty's bacterium combined naturally occurring genes, the Court held that the bacterium was not "nature's handiwork" but was in fact Chakrabarty's own

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[60] *Chakrabarty*, 447 U.S. at 309-10, 313; *Hartranft*, 121 U.S. at 615.

[61] *Funk Bros. Seed Co.*, 333 U.S. at 131.

[62] *Id.* at 131-32.

[63] *Id.*

[64] *Id.*

[65] *Chakrabarty*, 447 U.S. at 305-10.

"nonnaturally occurring manufacture or composition of matter" and therefore patentable.[66]

On its face, the invention in *Chakrabarty* appears directly analogous to the invention in *Funk Bros.*: the discovery of naturally occurring bacterial characteristics and their combination into a single, easy-to-use form. How the Court nonetheless came to such different conclusions in such similar cases is unclear. Many critics simply dismiss *Funk Bros.* as a poorly decided case that was more about obviousness than it was about subject matter.[67] If Bond's bacteria were obvious, however, why did not the Court simply decide the case on that ground, instead of deciding the case on patentable subject matter grounds? And more importantly, given that that Court opted to decide *Funk Bros.* on subject matter grounds, why were the results so different from the Court's later decision in *Chakrabarty*?

The superficial similarity between *Funk Bros.* and *Chakrabarty* stems from the fact that both inventions involved human recombination of naturally occurring characteristics into novel compositions. Chakrabarty had combined the naturally occurring petroleum-degradation qualities of multiple species into a single bacterium, and Bond had combined the naturally occurring mutual non-inhibition qualities of multiple bacterial strains into a single inoculant.[68] Both inventions thus displayed artifice – human intervention to create something that had not previously existed – and action – active function to accomplish some purpose.

Because artifice and action are not binary qualities, however, a patent applicant cannot simply point to any arguable characteristic of artifice and action. A claimed invention instead must demonstrate artifice and action sufficient to create markedly different characteristics from any found in nature. While Bond was able to demonstrate *some* artifice and action, that demonstration was not sufficient to convince the Court that the bacterial mixture was patentable technology, not a natural phenomenon.

As a first matter, Bond's bacterial mixture failed to display adequate artifice. Like most claimed inventions based on natural phenomena, Bond's inoculant involved some human intervention, if only to collect the bacterial strains at issue and combine them into a novel mixture. The Court saw this recombination of select bacterial strains as an obvious advance in "packaging" – the Court saw the degree and kind of human intervention needed to mix whole bacteria as minimal. Bond's inoculant thus did not possess the kind of artifice necessary for patentability. And although discovering which bacterial

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[66] *Id.* at 309-10. (Although the question of whether Chakrabarty's bacteria were products of nature was not an issue presented to the Court, the Court clearly agreed that "[h]is claim is not to a hitherto unknown natural phenomenon.").

[67] Efthimios Parasidis, *A Uniform Framework for Patent Eligibility*, 85 TUL. L. REV. 323, 351 (2010).

[68] *Compare Chakrabarty*, 447 U.S. at 305 n.1, *with Funk Bros. Seed Co.*, 333 U.S. at 129-30.

strains could be mixed without inhibiting one another required significant effort on Bond's part, the discovery of this mutual non-inhibition did nothing to change the bacteria themselves from their natural state.[69]

Moreover, although the *Funk Bros.* majority never used the term "obvious" in referring to Bond's bacterial mixture, both the Supreme Court and lower courts have subsequently used the terms "obvious," "token" and "well-understood, routine, conventional" frequently in their rejections of unpatentable subject matter.[70] These terms appear at first to be references to non-obviousness or other patentability requirements in ways that serve only to confuse the patentable subject matter inquiry. Courts' recurring focus on token elements can better be understood, however, as references to quantities of artifice and action such as the minimal level of artifice in *Funk Bros.*, that are insufficient for patentability.

One might question the actual difference in degree of artifice between *Funk Bros.*' bacterial mixture and the genetically engineered bacterium that the Court found patentable in *Chakrabarty*. Introducing genetic plasmids into the bacterium in *Chakrabarty* only arguably required more human intervention and thus only arguably more artifice than mixing the inoculant in *Funk Bros.*[71] Bond's inoculant in *Funk Bros.* suffered from not only an insufficient degree of artifice but also from a complete lack of humanly created action, as required under both the artifice and action requirements.

Specifically, Bond's bacteria were biologically active in a variety of ways, including nitrogen fixation, but none of these activities were humanly created in a way that would confer patentability. As the Court noted in that case, the individual bacteria in Bond's mixture continue to function in the same way and to the same ends as they had always functioned, and thus were merely "serv[ing] the ends nature originally provided."[72] *Chakrabarty*'s bacterium, on the other hand, was likewise biologically active in many naturally occurring functions but also now possessed a different, "distinctive" use – that of digesting petroleum.[73] Arguably, Chakrabarty's bacterium acted in ways that merely fused naturally occurring bacterial activity, and yet this fusion sufficiently altered the bacterium's overall functioning in a way that demonstrated human-made function – that is, patentable action *and* artifice.

The so-called purification line of cases also demonstrates how gradations in artifice and action distinguish patentable technology from unpatentable natural

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[69] *Funk Bros. Seed Co.*, 333 U.S. at 131; *see also infra* text accompanying notes 107-30 (discussing laws of nature as unpatentable subject mater).

[70] *See, e.g.*, Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1298 (2012); Bilski v. Kappos, 130 S. Ct. 3218, 3230 (2010) (quoting Diamond v. Diehr, 450 U.S. 175, 191-92 (1981)); Parker v. Flook, 437 U.S. 584, 590 (1978); Classen Immunotherapies, Inc. v. Biogen IDEC, 659 F.3d 1057, 1067 (Fed. Cir. 2011).

[71] *Chakrabarty*, 447 U.S. at 309-10.

[72] *Funk Bros. Seed Co.*, 333 U.S. at 131.

[73] *Chakrabarty*, 447 U.S. at 309-10.

phenomena. Courts are understandably wary of attempts to patent a naturally occurring substance based simply on purification or isolation of the substance from its natural state. Natural substances modified to create new chemical entities are patentable technology, but merely plucking a leaf from a tree is not.[74] In *General Electric Co. v. DeForest Radio*, for instance, the Third Circuit rejected an attempt to patent purified tungsten, holding that it was unpatentable subject matter.[75] Attempts to patent purified uranium and vanadium met similar fates,[76] as did attempts to patent purified pine needle fibers,[77] purified vitamin C,[78] purified ultramarine,[79] and purified alpha alumina.[80] In another series of decisions, however, courts upheld patents on purified forms of vitamin B_{12} and dolomite – both natural substances – holding them to be patentable subject matter.[81] What differentiated the former purifications from the latter?

The purification line of cases, like most patentable subject matter case law, varies a great deal in approach and evidences no one consistent policy or even linear progression. This general lack of coherence stems at least in part from the fact that many purification cases focus on novelty or non-obviousness rather than on patentable subject matter[82] and do not directly address the product of nature doctrine.[83]

That being said, a strong current underlying the purification line of cases is artifice and action. Regardless of whether the courts correctly understood the

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[74] Ass'n for Molecular Pathology v. Myriad Genetics, Inc. (*Myriad I*), 689 F.3d 1303, 1332 (Fed. Cir. 2012).

[75] Gen. Electric, Co. v. De Forest Radio, Co., 28 F.2d 641, 642-643 (3d Cir. 1928).

[76] *In re* Marden, 47 F.2d 957 (C.C.P.A. 1931); *In re* Marden, 47 F.2d 958, 959 (C.C.P.A. 1931).

[77] *Ex parte* Latimer, 1889 Dec. Comm'r Pat. 123, 125.

[78] *In re* King, 107 F.2d 618, 620 (C.C.P.A. 1939).

[79] *In re* Merz, 97 F.2d 599, 601 (C.C.P.A. 1938).

[80] *In re* Ridgway, 76 F.2d 602, 603 (C.C.P.A. 1935).

[81] Merck & Co. v. Olin Mathieson Chem. Corp., 253 F.2d 156, 161 (4th Cir. 1958); J.E. Baker v. Kennedy Refractories Co., 253 F. 739, 742 (3d Cir. 1918).

[82] *See, e.g.*, *In re* Bergstrom, 427 F.2d 1394, 1397 (C.C.P.A. 1970) (explicitly equating "new" under § 101 with novelty under § 102); *Merck & Co.*, 253 F.2d at 161 (looking only at novelty and utility requirements); *see also* Conley & Makowski, *supra* note 20, at 319-20, 387; Burton T. Ong, *Patenting the Biological Bounty of Nature: Re-Examining the Status of Organic Inventions as Patentable Subject Matter*, 8 MARQ. INTELL. PROP. L. REV. 1, 23 (2004).

[83] *See, e.g.*, *In re* Kratz, 592 F.2d 1169, 1174 (C.C.P.A. 1979) (addressing composition including 20% of naturally occurring strawberry flavor); *In re* Bergy, 563 F.2d 1031, 1032-33 (C.C.P.A. 1977) (focusing primarily on patentability of living organisms); Parke-Davis & Co. v. H.K. Mulford Co., 189 Fed. 95, 103 (S.D.N.Y. 1911), *aff'd*, 196 F. 496 (2d Cir. 1912) (addressing patentability of adrenaline base not found in nature); Farbenfabriken of Elberfeld Co. v. Kuehmsted, 171 F. 887, 890 (N.D. Ill. 1909) (addressing patentability of aspirin, a non-naturally occurring compound).

science behind each of these cases, the emphases are the same: did the claimed substances at issue appear to be altered enough in both form – artifice – as well as function – action – to be patentable subject matter? This Article obviously cannot present an exhaustive review of all purification case law, nor does it pretend to reconcile them all. Nonetheless, by comparing those cases in which purifications were held to be unpatentable with those in which they were patentable, one can readily trace the concepts of artifice and action.

Consider the cases in which purifications were held to be unpatentable subject matter. In *Ex parte Latimer*, the PTO rejected an application for somewhat purified pine needle fiber.[84] The fibers were intended for use in textile manufacturing, but the court noted that the fibers were not in any manner affected or produced by the process of which they were a result or that their natural condition as fibers "has in any wise been affected, changed or altered."[85] The fibers had undoubtedly been changed to some extent if only by virtue of their isolation from the "silicious, resinous, and pulpy parts of the pine needles," but this degree of artifice was obviously not sufficient for patentability.[86] The fibers were merely a "natural product," not a "new material."[87]

Yet other unpatentable natural products failed not only artifice but also action. In *DeForest Radio*, for example, the Third Circuit held that purified tungsten was not an invention but rather a product of nature.[88] The court focused on the functionality of the purified tungsten, finding that, although purified tungsten was eminently more ductile than and thus "immensely" more useful than the natural crystalline form, tungsten's ductility was simply one of its naturally occurring characteristics, not a "new characteristic" achieved through purification.[89] The Court of Customs and Patent Appeals ("CCPA") stated the same with regard to the heightened ductility of the purified vanadium and uranium.[90] A number of other cases followed similar reasoning to reject purified ultramarine,[91] purified vitamin C,[92] and purified alpha alumina[93] for failure to show new functionality over their naturally occurring forms.

In other words, the purified forms of tungsten, vanadium, and uranium failed to present any new utility or functionality and therefore all lacked

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[84] *Ex parte* Latimer, 1889 Dec. Comm'r Pat. 123, 123-25 (1889).

[85] *Id.* at 125.

[86] *Id.* at 123.

[87] *Id.* at 125; Conley & Makowski, *supra* note 20, at 321.

[88] Gen. Electric, Co. v. DeForest Radio, 28 F.2d 641, 642-43 (3d Cir. 1928).

[89] *Id.* at 643.

[90] *In re* Marden, 47 F.2d 957, 957 (C.C.P.A. 1931); *In re* Marden, 47 F.2d 958, 959 (C.C.P.A. 1931).

[91] *In re* Merz, 97 F.2d 599, 601 (C.C.P.A. 1938).

[92] *In re* King, 107 F.2d 618, 620 (C.C.P.A. 1939).

[93] *In re* Ridgway, 76 F.2d 602, 603 (C.C.P.A. 1935).

patentable action – the pure and naturally occurring forms were distinguishable only in the intensity of their naturally occurring characteristics. No matter how useful a purification may be, it is unpatentable if it differs from its natural occurring analog merely in degree and not in kind.[94]

In cases in which courts have found purifications to be patentable subject matter, by contrast, the purifications display artifice and action in the form of new functionality, not just intensification of naturally occurring characteristics. For example, ten years prior to its *DeForest Radio* decision, the Third Circuit in *J.E. Baker v. Kennedy Refractories Co.* held substantially purified dolomite, a naturally occurring form of magnesian limestone used to line metallurgical furnaces, to be patentable subject matter.[95] As the court explained, although a product of nature, the dolomite "is so transformed that new characteristics, both physical and chemical, are given it" that the purification process created a patentable manufacture.[96] Specifically, purification also gave the dolomite in *J.E. Baker* new functionality, and patentable new action, in the form of a moisture-resistant coating.[97]

The Second Circuit came to a similar conclusion in *Union Carbide v. American Carbide*, in which the court found crystalline calcium carbide to be patentable over its naturally occurring but impure amorphous form.[98] Like the purified dolomite in *J.E. Baker*, purification into crystalline form gave calcium carbide a different solubility, density, hardness, and a melting point than the natural, amorphous form, all of which the court saw as new chemical and physical qualities compared to its natural counterpart.[99]

The difference between purified tungsten, vanadium, and uranium on the one hand and purified dolomite and calcium carbide on the other is thus not just the degree but also the type of transformation involved. In *J.E. Baker* and *Union Carbide*, the purification process appeared to cause such significant physical and chemical changes – patentable artifice – that each purification acquired new, humanly appointed function – patentable action.

There are, of course, purification cases that, when looked at as a matter of rigorous scientific fact, do not seem consistent with the artifice-plus-action standard. For example, courts have differentiated purified prostaglandins,[100]

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[94] *In re* Merz, 97 F.2d at 601.

[95] J.E. Baker v. Kennedy Refractories Co., 253 F. 739, 739-42 (3d Cir. 1918).

[96] *Id.* at 742 (The court did not explicitly refer to the invention as "purified dolomite" but does clearly refer to the invention as the result of "freeing . . . raw dolomite" from "objectionable features," suggesting the removal of impurities.).

[97] *Id.* at 741.

[98] Union Carbide, Co. v. Am. Carbide, Co., 181 F. 104, 107 (2d Cir. 1910).

[99] *Id.* (although all these qualities of crystalline calcium carbide can be seen as characteristics, not "actions," they also are forms of action – i.e., "melting," "dissolving," "resisting impact" (hardness), and so on – that were material to calcium carbide's industrial uses.)

[100] *In re* Bergstrom, 427 F.2d 1394, 1397 (C.C.P.A. 1970).

vitamin B12,[101] tetracycline,[102] and norepinephrine[103] from their naturally occurring forms based on the fact that purification removed impurities that had previously made the natural form unusable, thereby effectively "transforming" the substance by giving it "new" functionality.[104] It is true that a product of nature modified to create new functionality could qualify as patentable subject matter. Scientifically speaking, however, simply removing inhibiting or dangerous impurities does not necessarily create new functionality but rather simply frees up existing functionality.[105]

Nonetheless, the courts in these cases clearly *perceived* the purification of prostaglandins, vitamin B12, and the other naturally occurring substances as creating "new" functionality. The way the courts viewed the facts, purification modified the natural substances into new ones, and the modification allowed the substances to operate in a way that they could not have been made to operate otherwise.[106] The standard the courts applied in these cases thus adheres to artifice and action as implicit requirements for patentable subject matter.

Laws of Nature

Laws of nature are observable, naturally occurring principles or "scientific truths."[107] Laws of nature include correlations and other precepts that define the relationships between natural forces and materials, such as the law of gravity or $E = mc^2$, a law of special relativity.[108] Courts sometimes analogize mathematical algorithms to laws of nature, presumably because mathematical

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[101] Merck & Co. v. Olin Mathieson Chem. Corp., 253 F.2d 156, 164 (4th Cir. 1958).

[102] Chas. Pfizer & Co. v. Barry-Martin Pharmas., Inc., 241 F. Supp. 191, 194 (S.D. Fla. 1965).

[103] Sterling Drug, Inc., v. Watson, 135 F. Supp. 173, 175-76 (D.D.C. 1955) (norepinephrine claimed under the pharmaceutical name "arterenol"); *see also* Parke-Davis & Co. v. H.K. Mulford Co., 189 F. 95, 103 (S.D.N.Y. 1911), *aff'd in part and rev'd in part,* 196 F. 496 (2d Cir. 1912) (suggesting this standard in dicta); Farbenfabriken of Elberfeld Co. v. Kuehmsted, 171 F. 887, 890 (C.C.N.D. Ill. 1909) (same); *see generally* Richard S. Gruner, *Intangible Inventions: Patentable Subject Matter for an Information Age*, 35 LOY. L.A. L. REV. 355, 399 (2002).

[104] *In re* Bergy, 563 F.2d 1031, 1032-33 (C.C.P.A. 1977); *In re* Bergstrom, 427 F.2d 1394, 1396 (C.C.P.A. 1970); *Merck & Co.*, 253 F.2d at 164; *Chas. Pfizer & Co.*, 241 F. Supp. at 194; Sterling Drug, Inc., v. Watson, 135 F. Supp. 173, 175-76 (D.D.C. 1955).

[105] Given that purified prostaglandins, vitamin B12, norepinephrine, bacteria, and perhaps even tetracycline all function *in vivo* the same way as they do in their purified forms – and the court's opinion in each of the respective cases certainly do not suggest otherwise - *In re Bergy*, 563 F.2d at 1032-33; *In re Bergstrom*, 427 F.2d at 1396; *Merck & Co*, 253 F.2d at 164; *Chas. Pfizer & Co.*, 241 F. Supp. at 194; *Sterling Drug, Inc.*, 135 F. at 175-76 – purification seems merely to have freed up naturally occurring functionality.

[106] *In re Bergstrom*, 427 F.2d at 1396.

[107] *See, e.g.*, Mackay Radio & Tel. Co. v. Radio Corp., 306 U.S. 86, 93-94 (1939).

[108] Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1293 (2012).

algorithms can be used to define either naturally occurring relationships between numbers or numerical relationships between naturally occurring phenomena and forces of nature.[109]

Much like phenomena of nature, laws of nature are unpatentable subject matter,[110] but as with phenomena of nature, how to distinguish laws of nature from patentable technology is not clear at first glance. A closer look reveals that laws of nature, like all other unpatentable subject matter, can be identified by their lack of adequate artifice and action.

Like phenomena of nature, laws of nature lack adequate artifice by definition – they are both the works of nature, not of human intervention. Unlike phenomena of nature, however, laws of nature also lack adequate action because they are merely descriptions of how natural phenomena behave.[111] Laws of nature such as the laws of physics, chemistry, mathematics, and biology (which are largely a composite of chemistry and physics) may have great value in describing or explaining various phenomena, but those descriptions are information, which is itself inert and does not itself "behave," "perform," or "operate" in any patentable way.[112]

Laws of nature are thus information only and do not themselves act or behave in any way, natural or humanly appointed. As the Supreme Court has often stated, "[i]f there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end,"[113] not merely for its descriptive content alone. Laws of nature or other informational works otherwise fail to create sufficient artifice and action.

In the Supreme Court's recent decision in *Mayo Collaborative Services. v. Prometheus Laboratories.*, for example, the patent at issue involved a method of improving thiopurine treatment of autoimmune disorders.[114] The method entailed administering the thiopurine, measuring the patient's thiopurine metabolite levels, and then adjusting subsequent thiopurine doses according to that data.[115] Although the method was novel and immensely useful, the Supreme Court rejected it as unpatentable subject matter.[116] Specifically, the method at issue was primarily a description of the correlation between a

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[109] *See, e.g.*, Diamond v. Diehr, 450 U.S. 175, 214-15 (1981); *see also Mackay Radio & Tel. Co.*, 306 U.S. at 94 (describing mathematical algorithms as "expressions of" scientific truths). *But see, e.g.*, Donald S. Chisum, *The Patentability of Algorithms*, 47 U. PITT. L. REV. 959, 980-84 (1986) (distinguishing algorithms from laws and phenomena of nature).

[110] *Prometheus Labs.*, 132 S. Ct. at 1293.

[111] *Id.* at 1297

[112] *Id.* at 1293.

[113] Gottschalk v. Benson, 409 U.S. 63, 67 (1972) (quoting in Funk Bros. Seed Co. v. Kalo Co., 333 U.S. 127, 130 (1948)); *accord Diehr*, 450 U.S. at 185-86.

[114] *Prometheus Labs.*, 132 S. Ct. at 1296-97.

[115] *Id.* at 1295.

[116] *Id* at 1294.

patient's metabolite levels and the effective dose of thiopurine.[117] And, as the Court noted, "a patent that simply *describes* [a naturally occurring] relation sets forth a natural law."[118]

Not all works employing the informational value of laws of nature are unpatentable, however. For example, contrast *Prometheus* with *Diamond v. Diehr*, decided thirty years earlier. .[119] The process at issue in *Diehr* applied a well-known mathematical algorithm (the Arrhenius equation) in a known method for curing rubber to identify when the rubber-curing process was complete, based on temperature and cure time.[120] The process in *Diehr* thus mirrored the process in *Prometheus* in that both used laws of nature to describe how to adjust known processes. Unlike the result in *Prometheus*, however, the result in *Diehr* was that the rubber-curing process at issue was patentable technology, not just an unpatentable law of nature.[121] What distinguishes these two cases?

Unlike the process in *Prometheus*, *Diehr*'s process entailed more than just a law of nature and the information it contains. *Diehr*'s process added what the Supreme Court saw as a significant number of additional elements that effectively added both artifice and action to the otherwise unpatentable law of nature. These steps involved manipulating and monitoring the rubber, including perhaps most significantly the use of "physical and chemical process[es] for molding precision synthetic rubber."[122] The addition of these other, active and artificial elements was "sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the natural law itself."[123]

The invention in *Diehr* was thus far more than just information about a naturally occurring correlation. The Arrhenius equation as used in *Diehr's* process was just a small part of a human-made process that actively operated in a variety of mechanical, chemical, and physical ways to transform uncured rubber.[124] Unlike the process in *Prometheus*, *Diehr's* process demonstrated more than adequate artifice and action.

That is not to say that *Prometheus*' method was completely devoid of

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[117] *Id.*

[118] *Id.* at 1297.

[119] Diamond v. Diehr, 450 U.S. 175, 184 (1981).

[120] *Id.*

[121] *Id.*

[122] *Id.*

[123] *Prometheus Labs.*, 132 S. Ct. at 1294 (citations omitted).

[124] *Diehr*, 450 U.S. at 184. In this regard, the Court gave an arguably liberal interpretation to claims 1 and 2 of Diehr's patent application, as neither of those claims directly state a "physical and chemical process" for curing rubber other than the operation of a rubber molding press. *See id.* at 179 n.5. Nonetheless, the Court apparently viewed those claims as describing the entire rubber molding process rather than just the calculation step of the process.

artifice or action. The drug dosage-adjustment method at issue did require the extra steps of administering the drug, allowing the patient to metabolize the drug, and then measuring its metabolites.[125] Yet those additional steps did not create *sufficient* artifice or action. The additional steps were merely those necessary to gather the relevant date for the correlation and to identify the relevant audience. None of these steps is enough to change the almost exclusively informational content of the method and to qualify for patentability.

Indeed, the *Prometheus* Court emphasized the scalar nature of patentable subject matter, placing the method along a spectrum between the Court's earlier decisions in *Parker v. Flook* and *Diehr*.[126] On the patentably artificial and active end of the spectrum is *Diehr*, with its significant physical and chemical steps. The process for adjusting alarm limits in *Flook*, by contrast, added no such active steps such as "chemical processes" or alarm triggering means.[127] Thus, instead of claiming a process that performed some active function, the patent in *Flook* claimed a process for calculating what was "simply a number" – i.e., simply information.[128] Because the *Prometheus* method was primarily informational in nature – as the Court said, "[t]o put the matter more succinctly, the claims inform a relevant audience about certain laws of nature"[129] – the Court decided it fell on the unpatentable *Flook* end of the spectrum.[130]

Abstract Ideas

Of the three main categories of excluded subject matter, abstract ideas are probably the most difficult to define, in part because the category is so expansive that it overlaps with other categories of subject matter, both excluded and included. Nonetheless, as with all patentable subject matter, the undertones of artifice and action are readily evident.

For example, unpatentable subject matter such as mental processes, human activity, legal and economic theory, raw data, literary, musical, and other expressive and descriptive materials all have been referred to as abstract ideas.[131] Laws of nature and mathematical algorithms have also been referred to as abstract ideas.[132] Indeed, if defined broadly enough, the term "abstract

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[125] Eisenberg, *supra* note 32, at 25-26.

[126] *Prometheus Labs.*, 132 S. Ct. at 1298-1300.

[127] *Id.* at 1299.

[128] *Diehr*, 450 U.S. at 186-187.

[129] *Prometheus Labs.*, 132 S. Ct. at 1298.

[130] *Id.* at 1299-1300.

[131] *See, e.g.*, MANUAL OF PATENT EXAMINING PROCEDURE § 2106.01 (8th ed. rev. 2006); *see also* Burk, *supra* note 34, at 141-42.

[132] *E.g.*, *Prometheus Labs.*, 132 S. Ct. at 1299-1300 (law of nature); Gottschalk v. Benson, 409 U.S. 63, 65, 68 (1972) (mathematical algorithm); *In re* Warmerdam, 33 F.3d 1354, 1360 (Fed Cir. 1994) (mathematical constructs are "the paradigmatic 'abstract idea'").

idea" could be used to characterize all patentable inventions, given that patents protect not concrete or tangible embodiments of an invention but rather the "abstract" inventive concept behind the invention.[133] Courts, of course, do not define the abstract idea category quite so broadly, but given the category's wide and amorphous boundaries otherwise, distinguishing a patentable inventive concept from an unpatentable abstract idea is difficult.

The Supreme Court's 2010 decision in *Bilski v. Kappos* is an example of this ambiguity. *Bilski* involved a so-called business-method of hedging risk against price changes in the energy commodities market.[134] The Court affirmed the Federal Circuit's decision that the method was an unpatentable abstract idea, but neither the Supreme Court nor the Federal Circuit seemed to be able to agree amongst themselves as to why. As Justice Stevens noted in his concurrence, the Court has "never provide[d] a satisfying account of what constitutes an unpatentable abstract idea."[135]

Given the overlap between abstract ideas, laws of nature, and even phenomena of nature, it should come as no surprise that abstract ideas also boil down to a lack of artifice and action. Phenomena, laws of nature, and mathematical algorithms rejected as abstract ideas obviously lack artifice. And even works displaying artifice, such as artistic works, philosophies, and even economic or other social science data, may be considered unpatentable abstract ideas for lack of action as merely informative or expressive. Data, instructions, expressive and artistic works, and other such abstract ideas are by definition "descriptive,"[136] and although potentially useful and even technological in nature,[137] descriptive material does not actively perform, behave, or operate the way technology does.

Courts have rejected many attempts to patent mathematical algorithms, data, and other more descriptive materials, even when claimed as used on computers or other devices. The overall utility of such works, whether performed in the human mind or in the processors of a computer, is still nothing other than their use as information or expression.[138] Similarly, additional steps such as data gathering or data storage in using an otherwise unpatentable law of nature are

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[133] *See, e.g.*, Bancorp Servs. v. Sun Life Assurance, 687 F.3d 1266, 1277 (Fed Cir. 2012); *In re* Freeman, 573 F.2d 1237, 1245-46 (C.C.P.A. 1978) *abrogated by In re Bilski*, 545 F.3d 943 (Fed. Cir. 2008); Chisum, *supra* note 109, at 974-75; *see also* Alan L. Durham, *The Paradox of "Abstract Ideas,"* 2011 UTAH L. REV. 797, 843-44; Morris, *supra* note 40, *Res or Rules*, at 498.

[134] Bilski v. Kappos, 130 S. Ct. 3218, 3223 (2010).

[135] *Id.* at 3236 (Stevens, J., concurring).

[136] *Interim Guidelines*, *supra* note 11, Annex IV, at 50-57; MANUAL OF PATENT EXAMINING PROCEDURE, *supra* note 131, at § 2106.01. The latest version of the Manual, however, places the distinction between functional and non-functional descriptive material under utility rather than patentable subject matter. *Id.* at § 2111.05.

[137] Karjala, *Distinguishing Patent, supra* note 35, at 448-49.

[138] Parker v. Flook, 437 U.S. 584, 590 n.11 (1978); Eisenberg, *supra* note 32, at 22-23.

dismissed as token limitations or strategic claim drafting.[139] In fact, such data gathering steps only emphasize the fact that the main purpose of the invention at issue is information, not technology.[140] Use of information, ideas, or laws of nature in inventions that act, function, or perform, on the other hand, satisfies both artifice and action.[141]

Moreover, mathematical algorithms, laws of nature, information and other descriptive materials are a form of intelligence and knowledge, not "useful Arts;" "[i]n other words, the patent statute does not allow patents on particular systems that depend for their operation on human intelligence *alone*, a field of endeavor that both the framers and Congress intended to be beyond the reach of patentable subject matter."[142]

Indeed, the same lack of artifice and action bars all inventions based primarily on human activity or thought. Patentable subject matter doctrine gives no suggestion "that processes for organizing human activity were or ever had been patentable."[143]Again, although all inventions require some degree of human intervention, thought, and creativity, that human intervention and creativity are the artifice necessary to create inventions, not inventions in themselves.[144] As the Supreme Court's decision in *Bilski* noted, "[c]oncerns about attempts to call any form of human activity a 'process' can be met by making sure the claim meets the requirements of [Section] 101"[145] – i.e., artifice and action.

Distinguishing abstract ideas from patentable technology is not always so clear, however, given that both artifice and action lie along a spectrum. Chief Judge Rader of the Federal Circuit adverted to this spectrum, stating that an unpatentable abstract idea "should exhibit itself so manifestly as to override the broad statutory categories of eligible subject matter."[146]

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[139] Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1294 (2012); Bancorp Servs. v. Sun Life Assurance Co., 687 F.3d 1266, 1277 (Fed. Cir. 2012); *see also Flook*, 437 U.S. at 593 (warning that rigid reading of § 101 "would make the determination of patentable subject matter depend simply on the draftsman's art").

[140] *See, e.g., Prometheus Labs.*, 132 S. Ct. at 1298.

[141] Classen Immunotherapies, Inc. v. Biogen IDEC, 659 F.3d 1057, 1067-68 (Fed. Cir. 2011) (using data to change the way vaccines affect patients is patentable process, not abstract idea); *see also* MANUAL OF PATENT EXAMINING PROCEDURE, *supra* note 131, at § 2106.01.

[142] *In re* Comiskey, 544 F.3d 967, 980 (Fed. Cir. 2009) (emphasis added).

[143] Bilski v. Kappos, 130 S. Ct. 3218, 3234 (2010) (Stevens, J., concurring) (quoting with approval *In re* Bilski, 545 F.3d 943, 972 (2008) (Dyk, J., concurring)). Justice Stevens appeared to have some doubt that the "abstract idea" category as currently defined provides adequate protection against patents on human activity, however.

[144] *See, e.g., In re* Alappat, 33 F.3d 1526, 1551 (Fed. Cir. 1994) (Archer, C.J., concurring in part and dissenting in part).

[145] *Bilski*, 130 S. Ct. at 3226.

[146] Research Corp. Techns., Inc. v. Microsoft Corp., 627 F.3d 859, 868 (2010); *Classen Immunotherapies, Inc.*, 659 F.3d at 1065; MySpace, Inc. v. Graphon Corp., 672 F.3d 1250,

Although works based solely on human thought or behavior are clearly unpatentable, there is no bright line rule as to exactly how much human behavior or thought a patentable process may entail. On the one hand, the business methods in *Bilski v. Kappos* and *In re Comiskey* involved almost exclusively mathematical algorithms and human activity and were clearly outside the realm of patentable subject matter.[147] On the other hand, for many inventions some level of human involvement is not only inevitable but also necessary. The PTO has granted a number of controversial patents on methods involving human activity, including methods of typing and lifting boxes so as to reduce the risk of injury, methods using sports equipment, and methods of performing surgeries.[148] The patentability of these methods appears to stem from the fact that they involve not only human activity but also action effectuated through non-human devices, such as surgical instruments, typewriters, and sports equipment.[149] The overall artifice and action of these latter methods are marginal at best, hence the controversy that surrounds them.

Machines, Manufactures, and Compositions of Matter

The discussion up to this point has focused on the categories of *unpatentable* subject matter, but the plain meanings of Section 101's included categories are also famously murky. The Supreme Court in *Bilski* suggests that these four statutory categories are "independent" of one another,[150] but the plain meanings of each category would seem to overlap not only with each other but also with unpatentable subject matter.[151] The apparent overlap applies only to the plain meanings of these categories, however, for the essential characteristics of artifice and action readily distinguish how Section 101's four categories of patentable subject matter are applied in practice.

1259 (Fed. Cir. 2012).

[147] *Bilski*, 130 S. Ct. at 3223-24; *In re Comiskey*, 554 F.3d at 970.

[148] F. Scott Kieff et al., *It's Your Turn, But It's My Move: Intellectual Property Protection for Sports "Moves,"* 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 765, 773 (2009) (noting controversy over sports method patents); Carl A. Kukkonen, *Be a Good Sport and Refrain from Using My Patented Putt: Intellectual Property Protection for Sports Related Movements*, 80 J. PAT. & TRADEMARK OFF. SOC'Y 808, 821-24 (1998); Gerard N. Magliocca, *Patenting the Curve Ball: Business Methods and Industry Norms*, 2009 BYU L. REV. 875, 875-77.

[149] *See also infra* Part.III.B. (discussing some of these patent types in more detail).

[150] *Bilski*, 130 S. Ct. at 3225.

[151] *See, e.g.*, Tilghman v. Proctor, 102 U.S. 707, 728 (1880) ("The line between a patentable 'process' and an unpatentable 'principle' is not always clear. Both are '[conceptions] of the mind, seen only by [their] effects when being executed or performed.'"); John. F. Duffy, *The Boundaries of Patent Law: Rules and Standards on the Forefront of Patentability*, 51 WM. & MARY L. REV. 609, 620 (2009) (noting "remarkable breadth" of statutory categories of inclusion); Robert A. Kreiss, *Patent Protection for Computer Programs and Mathematical Algorithms: The Constitutional Limitations for Patentable Subject Matter*, 29 N.M.L. REV. 31, 33 (1999).

Of the categories specifically listed under Section 101, perhaps the easiest to understand in terms of artifice and action is machines. Intuitively, machines are exactly what we might think of when we think of "technology."[152]

The Federal Circuit has defined a "machine" as "a concrete thing, consisting of parts, or of certain devices and combination of devices[,]" a definition that "includes every mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result."[153] Machines therefore satisfy the requirement of action, for the "mechanical" nature that defines machines means that machines perform work by leveraging any of a range of physical, rather than human, forces.[154] And although machines are defined largely by their operation, machines also meet the requirement of artifice as things that arise not in nature but through human assembly.[155]

Manufactures and compositions of matter are not as intuitively "technological" by their plain terms as machines are. According to the courts, manufactures are works that are "man-made, in the sense of having been encoded, generated, and transmitted by artificial means . . . giving to [raw] materials new forms, qualities, properties, or combinations, whether by hand-labor or by machinery."[156] Whereas machines are defined by their mechanical and other powers – that is, by their qualities of action – manufactures are defined by their artifice.

Compositions of matter are "all compositions of two or more substances and all composite articles, whether they be the results of chemical union, or of mechanical mixture, or whether they be gases, fluids, powders or solids."[157] One could conclude from this definition that compositions of matter do not need to display artifice, but the courts have affirmed that a "manufacture or composition of matter [is] a product of human ingenuity 'having a distinctive name, character [and] use.'"[158] Compositions of matter therefore possess

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[152] *See* DONALD CHISUM, 1-1 CHISUM ON PATENTS § 1.02(1) (2012) (and sources cited therein).

[153] *In re* Nuijten, 500 F.3d 1346, 1355 (Fed. Cir. 2007).

[154] *Mechanical Definition*, DICTIONARY.COM, http://dictionary.reference.com/browse/mechanical?s=t (last visited November 29, 2013). Although machines such as the telegraph, the telephone, and now computers have harnessed electromagnetic as well as mechanical forces for well over a century now, courts continue to define machines by their mechanical operations. *See, e.g.*, *In re* Ferguson, 558 F.3d 1359, 1364 (Fed. Cir. 2009). "Mechanical powers" thus presumably refers to all physical forces.

[155] One sometime sees sports and other references to the human body as a "machine," but for the most part, "machines" refer to non-natural entities.

[156] *In re Nuijten*, 500 F.3d at 1356 (citations omitted); *accord In re* Comiskey, 554 F.3d 967, 977 n.10 (Fed. Cir. 2009).

[157] Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980); *In re Nuijten*, 500 F.3d at 1357; *In re Comiskey*, 554 F.3d at 977 n.10.

[158] *Chakrabarty*, 447 U.S. at 309-10 (quoting Hartranft v. Wiegmann, 121 U.S. 609, 615 (1887)).

properties that belong to none of their constituent ingredients in their separate states.[159]

Whether any given item of manufacture or composition of matter displays the requisite action, however, is less obvious. Manufactures and compositions of matter may not always operate through mechanical devices or moving parts but instead may operate through chemical, biological, electromagnetic, or other physical forces. For example, pharmaceutical compositions of matter operate through chemical and biological forces, as did *Chakrabarty*'s genetically engineered bacteria.[160] Manufactures such as hand tools, golf balls, and toys act through mechanical forces. Even new molecules and new chemical elements operate through electromagnetic and sub-atomic forces.[161]

The definitions of machines, manufactures, and compositions of matter have much in common, however, not only with each other and with processes, as discussed below,[162] but also with the categories of unpatentable subject matter. Again, manufactures and compositions of matter are distinguishable from phenomena of nature only by virtue of their artifice and action. Given that all manufactures and compositions of matter derive from naturally occurring materials, however, the dividing line between the patentable and unpatentable is a question of degree.[163]

Two contrasting cases involving chemical treatment of naturally occurring raw materials provide examples on point.[164] In each case, the respective courts emphasized the implicit degree of both artifice and action that each claimed invention exhibited. In *American Fruit Growers, Inc. v. Brogdex Corp.*, the Supreme Court held that oranges with rinds that had been impregnated with borax to prevent mold were unpatentable products of nature.[165] Although better able to withstand molding, the treated orange "remains a fresh orange fit only for the same beneficial uses as theretofore" in the Court's eyes.[166] As the Court noted, "[t]he application of labor to an article, either by hand or by mechanism, does not make the article necessarily a manufactured article . . . something more is necessary . . . ."[167]

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[159] Robinson, *supra* note 49, at 278-79.

[160] *Chakrabarty*, 447 U.S. at 305 (describing the "energy-stabilizing" and "hydrocarbon degradative" chemical and biological actions of bacteria at issue).

[161] *See* Schering Corp. v. Gilbert, 153 F.2d 428 (2d Cir. 1946) (new molecule patentable); *In re* Seaborg, 328 F.2d 996 (C.C.P.A. 1964) (new element patentable); *In re* Breslow, 616 F.2d 516 (C.C.P.A. 1980) (new molecule patentable).

[162] *See infra* text accompanying notes 211-216.

[163] *See* Merck & Co. v. Olin Mathieson Chem. Corp., 253 F.2d 156, 161-62 (4th Cir. 1958).

[164] Am. Fruit Growers, Inc. v. Brogdex Co., 283 U.S. 1 (1931); Steinfur Patents Corp. v. William Beyer, Inc., 62 F.2d 238 (2d Cir. 1932).

[165] *Am. Fruit Growers*, 283 U.S. at 1-12.

[166] *Id.* at 12.

[167] *Id.* (internal quotation marks omitted).

Fur skins impregnated with ferrous sulphate to protect them from the damaging effects of and to accelerate later bleaching and dying, on the other hand, were held to be patentable manufactures in *Steinfur Patents Corp. v. William Beyer, Inc.*[168] In *Steinfur, the Second Circuit* viewed the treated furs to be different in both form and function, particularly in comparison to other untreated furs that "cannot be used in the same way as one which has been so impregnated."[169]

The differences between *Steinfur*'s treated furs and *Am. Fruit Growers*' treated oranges seem minimal at first. In both cases, the inventors treated naturally occurring products with chemicals in order to protect those products from damage. Indeed, from this angle, the two inventions seem almost identical. However, the differences in artifice and action between the two claimed inventions are significant.

The oranges in *Am. Fruit Growers* failed to demonstrate either adequate artifice or adequate action. Treating the rinds with borax neither altered the rinds nor gave them new functionality.[170] The borax did not chemically or physically react with the rinds, and the rinds did not bind with or activate the borax in any way.[171] As the patentees explained their invention, the oranges' rinds served merely to "carry" the borax, which was being used for its natural antifungal properties.[172] The Court also noted that the borax did not in any way change the fruits' edibility or freshness, lest it interfere with the natural function of the oranges as foodstuffs.[173] Thus, while treating the oranges with borax to prevent mold might be patentable as a process, the process itself did not create any "new or distinctive article" (artifice) "'having a distinctive name, character or use'" (artifice and action).[174]

As the Second Circuit explained in *Steinfur*, by contrast, treating furs with ferrous sulfate somehow changed both their leather and their hair so that their strength, luster, and texture were not damaged by later bleaching and dying the way they would have been without such treatment.[175] In other words, the furs' natural qualities were to react to bleaching and dying in deleterious ways, but treating them with ferrous sulfate gave the furs the new qualities of resistance to harm from bleaching and dying.[176] Unlike *Am. Fruit Growers*' oranges, the furs in *Steinfur* demonstrated both patentable artifice and action: "[b]y such

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[168] *Steinfur*, 62 F.2d at 238-40.

[169] *Id.* at 240.

[170] *Am. Fruit Growers*, 283 U.S. at 11-12.

[171] *Id.*

[172] *Am. Fruit Growers*, 283 U.S. at 6, 9.

[173] *Id.*

[174] *Id.* at 11-13 (quoting Hartranft v. Wiegmann, 121 U.S. 609, 613-615 (1887) (holding that acid-cleaned and buffed sea shells to expose their natural qualities were not patentable articles of manufacture)).

[175] *Steinfur*, 62 F.2d at 238-40.

[176] *Steinfur*, 62 F.2d at 239-40.

impregnation the skin attains a new quality which gives it a new beneficial use . . . it fits it to be used for bleaching by a method which could not without such impregnation be successfully employed."[177]

Another area in which patentable machines and manufactures overlap with unpatentable subject matter, particularly after the advent of the computer age, is with descriptive materials such as raw data or expressive works. Computers, CDs, and other storage media are often used to store informational or expressive material, but courts routinely hold that merely storing data on computer-readable media does not transform otherwise unpatentable descriptive material into a patentable manufacture or composition of matter.[178] How do we resolve patentable subject matter issues when unpatentable descriptive material is stored in otherwise patentable machines and manufactures? Obviously, computers, electronic storage media, and just about any other machine or manufacture on which descriptive material can be processed or stored are clearly patentable subject matter as exactly that – machines and manufactures.

Computer or storage media that are distinguishable from existing technology only by the informational or expressive content stored on them, however, have often been rejected under various incarnations of the "printed matter" doctrine[179] The printed-matter doctrine states that a machine or manufacture that differs from the prior art only by virtue of the information or expression stored on it is "unpatentably obvious" over that prior art if that content has no "functional" relationship with the device.[180]

Although somewhat controversial in its own right,[181] and in any event primarily a doctrine about non-obviousness under Section 103, the printed-matter doctrine clearly has implications for patentable subject matter inquiries under Section 101. Identifying whether a work is printed matter is in large part a characterization of its subject matter, and the subsequent determination of whether that printed matter serves a purely "non-functional" (i.e., descriptive) role in an invention has profound implications for whether that subject matter is patentable or unpatentable, particularly when it comes to computer software.[182] Indeed, the way in which the printed-matter doctrine has been used in a number of patentable subject matter cases provides a further illustration of the importance of artifice and action.[183]

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[177] *Id.* at 240.

[178] MANUAL OF PATENT EXAMINING PROCEDURE , *supra* note 131, at § 2106.

[179] *See, e.g.*, CHISUM, CHISUM ON PATENTS, *supra* note 152, at § 1.02[4].

[180] *See In re* Nuijten, 500 F.3d 1346, 1365-66 (Fed. Cir. 2007); Burk, *supra* note 34, at 141-45; Collins, *supra* note 45.

[181] *See infra* text accompanying notes 249-267 on the printed-matter doctrine and point-of-novelty approaches generally.

[182] Burk, *supra* note 34, at 141-45.

[183] *See id.*; *see also* MANUAL OF PATENT EXAMINING PROCEDURE, *supra* note 131, at § 2106.

In the case *In re McKee*, the CCPA invoked the printed-matter doctrine to reject an application to patent cuts of meat marked in a particular way for identification.[184] The cuts of meat, as *de minimis* variations on natural substances, were clearly unpatentable, and even claims for the method of marking the meats were unpatentable.[185] Marking did nothing to alter the meats other than to store information on them.[186] Similarly, the CCPA rejected the method of using particular symbols to notate piano music at issue in *In re Rice*.[187] In both cases, the printing at issue did not produce "a novel form" or a "form [that] served a new and useful purpose;"[188] in both cases, the printing at issue did not produce either artifice or action.

In other cases, the printed-matter doctrine was not a bar to patentability. For example, in *In re Jones*, the CCPA rejected a printed-matter challenge to the patentability of an encoder disc distinguished only by the new pattern burned into it.[189] Unlike the two unpatentable printed works in *McKee* and *Rice*, the encoder disc in *Jones* was a new way of storing and conveying information in a way independent of *what* information it stored or conveyed. The pattern on the disc was not information itself but rather a way of physically altering light rays directed through the disc to increase the accuracy of the information thereby conveyed.[190] The invention was thus not one of inert information but in fact one of patentable action.[191]

Printed or descriptive matter may display adequate artifice as the product of human creativity, but it fails action. At its most basic level, the printed-matter doctrine embodies the idea that patentable inventions must operate in some way and cannot simply exist as information or expression. The printed-matter doctrine is thus just a variation on the unpatentability of abstract ideas, algorithms, or mental steps.[192] If an invention involves little more than algorithms, mental steps, or abstract ideas, it is just information, and without more, information always fails the artifice-plus-action standard.

Of course, unpatentable "printed matter" or other abstract ideas need not be

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[184] *In re* McKee, 64 F.2d 379, 379-80 (C.C.P.A. 1933).

[185] *Id.*

[186] *Id.*

[187] *In re* Rice, 132 F.2d 140, 140-41 (C.C.P.A. 1942).

[188] *In re McKee*, 64 F.2d at 380; *accord In re Rice*, 132 F.2d at 141 (quoting *In re McKee*).

[189] *In re* Jones, 373 F.2d 1007 (C.C.P.A. 1967).

[190] *Id.* at 1013.

[191] *Id.; see also In re* Gulack, 703 F.2d 1381, 1386-87 (Fed. Cir. 1983) (Educational band imprinted with prime numbers is patentable subject matter because band functioned not only to display digits but also to demonstrate their characteristics physically); Cincinnati Traction Co. v. Pope, 210 F. 443, 446-47 (6th Cir. 1913) (finding patentable streetcar transfer ticket books functioned even without printed matter).

[192] CHISUM, CHISUM ON PATENTS, *supra* note 152, at § 1.02[4] (comparing printed matter with mental steps); Burk, *supra* note 34, at 143.

printed or in fact fixed in any sort of tangible medium.[193] One of the most interesting examples of this is *In re Nuijten*.[194] *Nuijten* involved an attempt to patent a "signal" used in a process to dampen distortions caused by watermarking transmission of digital audio files and other expressive or descriptive content.[195]

In determining whether the signals were patentable subject matter, the majority began by construing the patent's claims.[196] Although the majority decided that the signals required a physical carrier, the court noted that *any* physical carrier would do, leaving open the possibility that the signals were significant not for their physical structure, but rather for the non-physical descriptive material they encoded.[197]

Rather than focusing on the significance of the potential distinction between the signal and its physical carrier, the majority instead interpreted the distinction as meaning that the signals were non-corporeal and even "transitory" in nature.[198] According to the majority, machines, manufactures, or compositions of matter comprise only corporeal and tangible "parts," "articles," and "substances," thus not covering Nuijten's signals.[199] Without really explaining why, the court also stated that, while Nuijten's signals were certainly the product of a process, the signals themselves were not a "process" because they did not perform such actions or steps.[200] Nuijten's signals were therefore not patentable subject matter. [201] The majority's decision to focus on the intangible and transitory nature of the signals quickly came under criticism, not the least of which came from Judge Linn's dissent. To Judge Linn, an intangible, transitory, but nonetheless physical invention could indeed be considered an article of manufacture.[202] Further, a signal made from a physical carrier like electromagnetic energy could easily qualify as "anything made for use from raw or prepared materials."[203]

The most telling parts of the decision were Judge Linn's dissenting comments on whether the signals were merely "abstract ideas."[204] Relying in part on the printed-matter doctrine, Judge Linn argued that the signals were a physical means for *carrying* information and data, not an attempt to claim

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[193] Burk, *supra* note 34, at 142-43; Collins, *supra* note 44, *passim*.

[194] *In re* Nuijten, 500 F.3d 1346 (Fed. Cir. 2007).

[195] *Id.* at 1348.

[196] *Id.* at 1352-54.

[197] *Id.* at 1346-54.

[198] *Id.* at 1353.

[199] *Id.* at 1357.

[200] *Id.* at 1354-57.

[201] *Id.* at 1357.

[202] *Id.* at 1358.

[203] *Id.* at 1360.

[204] *Id.* at 1363.

information itself.[205] This was a point that the majority's opinion did not even mention – at least, not expressly. The majority did advert to the informational content of the signals, but instead of focusing on this informational content, the majority focused on the tangibility of the signals. The dissent, on the other hand, seemed to discount the signal's informational content, arguing that "[a]ny information that it conveys is distinct from the invention itself."[206]

While it is true that *carrying* information is a type of patentable action that the signals possessed, the signals were also in part information.[207] The claim on the signal described it as containing "supplemental data," referring to the modifications to the watermark data, which were themselves modifications to the original video or audio data.[208] Thus, although Nuijten was not attempting to claim the video or audio data that his signal carried, he was claiming modified watermark data.[209] *Nuijten* thus provides an example at the margin between unpatentable information and patentable action.

Rather than recognizing the scalar nature of patentable action and addressing whether *Nuijten*'s signals displayed sufficient action, both the majority and the dissent opted to take much more black-and-white, and ultimately more confusing, approaches to the case. Applying an artifice-plus-action standard might not have resolved the disagreement between the majority and dissent opinions on the more technical issue of whether the signals were information themselves or carriers of information. Looking at the case through the lens of artifice and action certainly would have brought the dispute into sharper focus and avoided what were ultimately distracting discussions about whether transitory or ephemeral inventions qualify as articles of manufacture.[210]

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[205] *Id.* at 1365.

[206] *Id.* at 1365-68 (holding that the signals are not information alone since otherwise, a storage medium for storing the signals, a claim the PTO has approved, would not be patentable under the printed-matter doctrine).

[207] The *Nuijten* signals thus differed from the "signals" in *In re Walter*, which the C.C.P.A. found to have no physical carrier, and therefore to be merely abstract mathematical data. *In re* Walter, 618 F.2d 758, at 769-70 (C.C.P.A. 1980).

[208] *In re Nuijten*, 500 F.3d at 1351.

[209] *Id.* at 1365. In fact, the PTO rejected the claim on the signal as "merely data." *Id.* at 1353.

[210] For example, the court conceivably could have compared the degree of patentable action Nuijten's signal displayed with the physical cardiac electrical impulses transformed into signals by the patented technology in *Arrhythmia Res. Tech. v. Corazonix Corp.*, 958 F.2d 1053, 1059 (Fed. Cir. 1992). The *Nuijten* majority did address *Corazonix* to a limited extent. *In re Nuijten*, 500 F.3d at 1353. The court could have also compared Nuijten's signal to the physical seismic wave signals in *In re Taner*, 681 F.2d 787, 790 (C.C.P.A. 1982). In both *Arrhythmia* and *Taner*, the signals were naturally occurring phenomena, and so were not evaluated as patentable subject matter themselves.

Processes

Of all the categories of patentable subject matter, processes are perhaps the most difficult to parse.[211] Although processes often involve the use of manufactures, machines, and compositions of matter, processes differ from the other three categories of patentable subject matter because processes are states of activity, not corporeal or structural entities.[212] Indeed, a process is in many ways the purest form of action, for a process is an act or a series of acts or steps.[213]

Whether any given process displays adequate *patentable* action, as well as adequate artifice, is another issue. The difficulty with processes lies in the fact that the definition of a process is broad and could encompass much that is not patentable, including algorithms, abstract ideas, and human thought and action.[214] Perhaps the most cogent example of how artifice and action distinguish patentable processes from unpatentable processes, as well as how difficult that distinction can be to draw, is the Federal Circuit's vacillations over the proper linguistic test for identifying patentable processes.

For many years, the Federal Circuit applied the *Freeman-Walter-Abele* test, particularly for computer software claims.[215] The *Freeman-Walter-Abele* test was a two-step test. First, the court had to determine whether the claim involved a mathematical algorithm, formula, or mental step.[216] If so, the court would then look at whether the algorithm or mental step was applied to specific physical elements or physical steps.[217]

Criticized for its potentially simplistic focus on particular claim elements,[218] the *Freeman-Walter-Abele* test was soon supplanted by the test the Federal Circuit first put forth in *In re Alappat*: does the process yield a useful, concrete, and tangible result?[219] The useful, concrete, and tangible test required

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[211] *See, e.g.*, Parker v. Flook, 437 U.S. 584, 592 (1978) (noting difficulty of discerning patentable processes from unpatentable "principles").

[212] *Id.* at 589 & 588 n.9; *see also* CHISUM, CHISUM ON PATENTS, *supra* note 152, at § 1.03.

[213] *In re Nuijten*, 500 F.3d at 1355 ("The Supreme Court and this court have consistently interpreted the statutory term 'process' to require action.").

[214] *See, e.g.*, *Flook*, 437 U. S. at 589 & 588 n.9; Tilghman v. Proctor, 102 U.S. 707, 728 (1880); Duffy, *supra* note 151, at 620; Kreiss, *supra* note 151, at 33.

[215] *In re* Abele, 684 F.2d 902, 905 (C.C.P.A. 1982); *In re* Walter, 618 F.2d 758, 767 (C.C.P.A. 1980); *In re* Freeman, 573 F.2d 1237, 1245 (C.C.P.A 1978).

[216] *In re Abele*, 684 F.2d at 905.

[217] *Id.* at 907 (quoting *In re Walter*, 618 F.2d at 767); *accord* Arrhythmia Res. Tech. v. Corazonix Corp., 958 F.2d 1053, 1058 (Fed. Cir. 1992); *In re* Grams, 888 F.2d 835, 838-39 (Fed. Cir. 1989).

[218] *In re* Bilski, 545 F.3d 943, 958-59 (Fed. Cir. 2008) (en banc); AT&T Corp. v. Excel Comm. Mktg., Inc., 172 F.3d 1352, 1356 (Fed. Cir. 1999); Chiappetta, *supra* note 34, at 108 n.85; *see also infra* text accompanying notes 249-267 on the point-of-novelty approach.

[219] *AT&T Corp.*, 172 F.3d at 1358; *Interim Guidelines*, *supra* note 11, at 40, 45-46; Julie

only that a claimed process employ specific steps to accomplish specific results and rejected any requirement that algorithms be applied to or limited by physical elements or steps.

The useful, concrete and tangible test was thus more expansive than *Freeman-Walter-Abele*.[220] For example, in its most famous application, this test was used to approve the computer-operated financial services system at issue in *State Street Bank & Trust Co. v. Signature Financial Group*.[221] Although the system did nothing more than crunch numbers, the Federal Circuit stated that the system "transformed" data and was therefore useful and specific enough to be patentable subject matter.[222] Similarly, in *AT&T Corp. v. Excel Communications*, the Federal Circuit approved of a claimed process for generating annotated long-distance telephone data, stating that because the data in question was both useful and specific, the method passed under the useful, concrete, and tangible test.[223] Not surprisingly, the test quickly came under fire for its expansive effect on patentable subject matter boundaries.[224]

The Federal Circuit soon swung away from the liberality of the useful, concrete, and tangible in *In re Bilski* by adopting the "machine-or-transformation" test instead.[225] Under this test, a process is patentable if it either: (1) is tied to a particular machine or apparatus: or (2) transforms a particular article into a different state or thing.[226] The machine-or-transformation test, like the *Freeman-Walter-Abele* test before it, is thus less expansive than the useful, concrete, and tangible test.[227] The Supreme Court subsequently cautioned that the machine-or-transformation test cannot be the sole test for patentable processes but also acknowledged that the test is nonetheless a "useful and important clue."[228] Lower courts have continued to use the machine-or-transformation test as their go-to yardstick for processes under Section 101.[229]

E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CALIF. L. REV. 1, 10 (2001).

[220] *AT&T Corp.*, 172 F.3d at 1358; *In re* Alappat, 33 F.3d 1526, 1570 (Fed. Cir. 1994).

[221] State Street Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368 (Fed. Cir. 1998).

[222] *Id.* at 1373-75.

[223] *AT&T Corp.*, 172 F.3d at 1357-58.

[224] *In re* Bilski, 545 F.3d 943, 1004-05 (Fed. Cir. 2008) (Mayer, J., dissenting).

[225] *Id.* at 960.

[226] *Id.* at 961-62.

[227] *See generally id.* at 964-65; *see also* Katherine J. Strandburg, *Much Ado Preemption*, 50 HOUS. L. REV. 563, 567 (2012); *see also infra* text accompanying notes 236-237.

[228] Bilski v. Kappos, 130 S. Ct. 3218, 3227 (2010).

[229] *See, e.g.*, Bancorp Servs., L.L.C. v. Sun Life Assurance Co., 687 F.3d 1266, 1278 (Fed. Cir. 2012); PerkinElmer, Inc. v. Intema Ltd., 496 Fed. App'x 65, 72 (Fed. Cir. 2012); CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1370-71 (Fed Cir. 2011); *see also* Mark A. Lemley et al., *Life After* Bilski, 63 STAN. L. REV. 1315, 1316 (2011) ("[T]he U.S. Patent and Trademark Office (PTO), patent litigants, and district courts have all

The Federal Circuit's rejection of the "useful, concrete, and tangible test" in favor of the machine-or-transformation test demonstrates a notable pattern. By insisting that a patentable process be limited by a machine or by a transformative or physical process step, the machine-or-transformation test effectively returns to cabining patentable subject matter in a way very similar to *Freeman-Walter-Abele*. Specifically, the *Freeman-Walter-Abele* and machine-or-transformation tests resemble each other in ways that comport with the requirements of artifice plus action.

For example, *Freeman-Walter-Abele*'s physicality requirement is a strong proxy for patentable action through physical forces and effects. A machine or other apparatus operates through electrical or mechanical action, and any chemical, biological, mechanical, or other physical process step would also create patentable action. And while the Federal Circuit rejected the idea that the machine-or-transformation test has any such physicality requirement, using a physical means such as a machine or apparatus or producing some physical transformation is an easy way to satisfy the machine-or-transformation test, as suggested by the Supreme Court's earlier decisions on which the Federal Circuit based the machine-or-transformation test,[230] including several *Freeman-Walter-Abele* decisions.[231] In *Diehr*, for example, the Supreme Court stated that "[t]ransformation and reduction of an article 'to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines."[232] Physicality can also help satisfy the artifice requirement, as machines and other apparatuses are human-made, and transformation of physical articles is artificial as well.

Consistent with this emphasis on patentable action, both the machine-or-transformation and *Freeman-Walter-Abele* tests disallow data and information processing inventions.[233] "[I]f the end-product of a claimed invention is a pure number, as in *Benson* and *Flook*, the invention is non-statutory regardless of

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continued to rely on the machine-or-transformation test in the wake of *Bilski*: no longer as the sole rule, but as a presumptive starting point that threatens to become effectively mandatory.").

[230] *In re Bilski*, 545 F.3d at 961 (quoting Gottschalk v. Benson, 409 U.S. 63, 70 (1972)); *In re* Comiskey, 554 F.3d 967, 978-79 (Fed. Cir. 2009).

[231] *In re Bilski*, 545 F.3d at 962-63;*see In re Comiskey*, 554 F.3d at 979-80 (citing also *In re* Warmerdam, 33 F.3d 1354, 1359-60 (Fed. Cir. 1994)); *In re* Grams, 888 F.2d 835, 838-40 (Fed. Cir. 1989); *In re* Abele, 684 F.2d 902, 908-09 (C.C.P.A. 1982); *In re* Meyer, 688 F.2d 789, 795-96 (C.C.P.A. 1982) (explaining the physical aspects of the machine-or-transformation test).

[232] Diamond v. Diehr, 450 U.S. 175, 184 (1981) (quoting Cochrane v. Deener, 94 U.S. 780, 787-788 (1877)); *see also Bilski*, 130 S. Ct. at 3244-45 (Stevens, J., dissenting) (questioning whether patent law was originally devised to address only tangible and physical inventions).

[233] *See, e.g.*, *In re Bilski*, 545 F.3d at 965 (rejecting "transformation" of one number to another as inadequate under the machine-or-transformation test); DealerTrack, Inc. v. Huber, 674 F.3d 1315, 1333 (Fed. Cir. 2012).

any post-solution activity which makes it available for use by a person or machine for other purposes."[234] Likewise, human thought or human activity, without more, has been held to fail both tests.[235]

The useful, concrete, and tangible test, by contrast, focused almost exclusively on specificity and utility and excluded only abstract ideas that were too vague while including those that that, under the *Freeman-Walter-Abele* or machine-or-transformation tests, would have been too inert or inactive. With almost no regard for patentable action or artifice, the useful, concrete, and tangible test allowed patenting of what other courts have before and since excluded as mental processes, mathematical algorithms, and human behavior.

For example, under the useful, concrete, and tangible test, "the mere fact that a claimed invention involves inputting numbers, calculating numbers, outputting numbers, and storing numbers, in and of itself, would not render it non-statutory subject matter," as long as those numbers represented something specific and useful.[236] Equally controversial was the inclusion of methods involving primarily human behavior or mental processes as patentable under this test. As Judge Mayer noted in his *Bilski* dissent, the useful, concrete, and tangible test gave rise to patents covering financial methods, methods of dating, and even methods for getting patents, many of which "rang[ed] from the somewhat ridiculous to the truly absurd."[237] The useful, concrete, and tangible test thus deviated from long-held resistance to patenting numbers, algorithms, and human behavior and thought. In particular, the useful, concrete, and tangible test lacked any implicit requirement that inventions display patentable action.

Despite the machine-or-transformation test's continuing usefulness, the Supreme Court has expressed concern that the test "would create uncertainty" about information-age technologies.[238] The Court's reservations about the machine-or-transformation test connote the sense that, while useful, the machine-or-transformation test does not completely capture what distinguishes

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[234] *In re* Walter, 618 F.2d 758, 767-68 (C.C.P.A. 1980).

[235] *In re Bilski*, 545 F.3d at 961 n.26, 964 (discussing that human thought is unpatentable and human activity is not "physical activity" or transformative); *In re Comiskey*, 554 F.3d at 980 (same); *In re* Schrader, 22 F.3d 290, 293-94 (Fed. Cir. 1994) (asserting that human activity of bidding not "physical" under *Freeman-Walter-Abele*).

[236] State Street Bank & Trust Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1374 (Fed. Cir. 1998) (quoting *In re* Alappat, 33 F.3d 1526, 1544 (1994)).

[237] *In re Bilski*, 545 F.3d at 1004 (Mayer, J., dissenting); *Summary of the Manager's Amendment*, 157 CONG. REC. S1367 (daily ed. Mar. 8, 2011) (stating that in enacting the America Invents Act, Congress created a special transitional program to allow post-grant review challenges to eliminate "the backwash of invalid business method patents" granted in the wake of *State Street Bank*); *see also infra* text accompanying notes 290-316 (discussing business method patents).

[238] Bilski v. Kappos, 130 S. Ct. 3218, 3227 (2010) (discussing the uncertainty concerns about computer software, medical diagnostic techniques, data compression, and the manipulation of digital signals).

patentable subject matter. Some inventions that are neither tied to machines or apparatuses nor transformative in effect may nonetheless display adequate action and artifice. Other inventions that do involve either machines or transformation, on the other hand, may not be sufficiently active or artificial.

The *In re Bilski* court noted this difficulty in addressing machine-operated processes in the Supreme Court's earlier decision *Gottschalk v. Benson*, one of the cases from which the Federal Circuit drew the machine-or-transformation test.[239] In addressing a computer program that performed a specific mathematical calculation, the Court held that, although the program operated on a machine (a digital computer), the program was unpatentable because it had no utility – that is, performed no patentable action – other than providing information in the form of the solution to a mathematical algorithm.[240] The machine-or-transformation test, like its *Freeman-Walter-Abele* predecessor, may fail to discount insignificant ties to machines or token pre- or post-solution activities such as data gathering.

The difficulty of deciding when machine or transformation limitations are merely tokens of strategic claiming stems from the fact that, unlike the more binary framework of either the machine-or-transformation or *Freeman-Walter-Abele* test, patentable action and artifice are a matter of degree. The scalar nature of action and artifice requires that the machine-or-transformation, *Freeman-Walter-Abele*, and other such tests apply what is effectively an additional token limitations doctrine to weed out insignificant limitations that might otherwise have satisfied these patentability tests.

For example, one line of cases rebuffs attempts to patent unpatentable processes through token limitations to existing machines or manufactures.[241] This line of cases holds that claiming a general-purpose computer in the performance of simple "number crunching" is "an attempt to exalt form over substance since the claim is really to the method or series of functions itself."[242] Where a machine "function[s] solely as an obvious mechanism for permitting a solution to be achieved more quickly, i.e., through the utilization of a computer for performing calculations," the machine limitation is not meaningful.[243]

Another line of cases under the so-called new-machine doctrine states the exact opposite proposition. In *In re Alappat*, for example, the court stated that "a general purpose computer in effect becomes a special purpose computer

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[239] *In re Bilski*, 545 F.3d at 954 (citing Gottschalk v. Benson, 409 U.S. 63, 70 (1972)).

[240] *See Benson*, 409 U.S. at 71-72.

[241] *See* CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1374-75 (Fed. Cir. 2011); *In re* Grams, 888 F.2d 835, 840-41 (Fed. Cir. 1989) (Tying unpatentable process to programmed computer does not make it patentable.); *In re* Abele, 684 F.2d 902, 909 (C.C.P.A.1982); *In re* Meyer, 688 F.2d 789, 795 n.3 (C.C.P.A. 1982); *In re* Gelnovatch, 595 F.2d 32, 37 (C.C.P.A.1979).

[242] *In re Abele*, 684 F.2d at 909.

[243] SiRF Tech., Inc. v. Int'l Trade Comm'n, 601 F.3d 1319, 1333 (Fed. Cir. 2010).

once it is programmed to perform particular functions" and hence an independently patentable machine.[244] Under the approach of this line of cases, programming a computer with new software physically "changes" it so that it has new "electrical paths" and new memory elements.[245]

On the surface these two lines of case law appear to adopt diametrically opposing views on the patentability of processes performed on computers or other such machines. On the one hand, if a computer is patentable as a machine when originally invented, how can it become unpatentable simply because of the addition of an unpatentable process?[246] A "new" computer performing that process may be neither novel nor non-obvious, but it would presumably still qualify as a "machine" within the meaning of Section101. But on the other hand, why allow an effective end-run around the unpatentability of abstract ideas by condoning strategic claiming and the addition of machines as token limitations?

Nonetheless, both lines of cases can be seen as consistent with artifice and action. Although appearing rather liberal, the new-machine doctrine cases generally involve the use of computers for more than just calculating or computing data. The vast majority involve not just data computation or storage but also patentable action, in a variety of forms: generating pulse; mechanical drafting; spatially locating and displaying items; rotating and stopping a slot machine reel; conversion of electrical and magnetic seismic traces into cross-sectional maps; conversion of cardiac electrical impulses into digital signals; and new physical combinations of and interactions between computer circuitry components.[247] The patentable action in many of these cases is marginal, to be

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[244] *In re Alappat*, 33 F.3d at 1545; *accord In re* Prater, 415 F.2d 1393, 1403 n.29 (C.C.P.A. 1969).

[245] WMS Gaming Inc. v. Int'l Game Techn., 184 F.3d 1339, 1348 (Fed. Cir. 1999); *In re* Bernhart, 417 F.2d 1395, 1400 (C.C.P.A. 1969).

[246] *See* Chiappetta, *supra* note 34, at 131.

[247] *See, e.g.*, WMS Gaming, 184 F.3d at 1346-47; *In re Alappat*, 33 F.3d at 1541-42 & n.17 (noting addition of barrel shifter and logic circuit components distinguished claimed rasterizer from prior art rasterizers); Arrhythmia Res. Tech. v. Corazonix Corp., 958 F.2d 1053, 1059 (Fed. Cir. 1992) (under *Freeman-Walter-Abele*, apparatus construed to convert "analog" electrical impulses generated by the heart into digital signals); *In re* Iwahashi, 888 F.2d 1370, 1375 (Fed. Cir. 1989) (improved autocorrelation apparatus defined by "specific structural limitations"); *In re* Sherwood, 613 F.2d 809, 819 (C.C.P.A. 1980) (under *Freeman-Walter-Abele*, apparatus construed as including means for "sonogramming," "dividing," and "plotting"); *In re* Freeman, 573 F.2d 1237, 1240 (1978) (computation means combined with computer display means and mechanisms for specifying shape and position of symbol images); *In re* Noll, 545 F.2d 141, 148 (C.C.P.A.1976) (claimed machine included machine general purpose computer, pulse generators, master clock, and display device); *In re* Bernhart, 417 F.2d at 1399 (allowed apparatus claim construed as including "mechanical drafting machines" as well as computing machines, but disallowed apparatus claims construed as including only general purpose computer). An exhaustive survey of cases applying the new-machine doctrine is of course beyond the scope of this Article.

sure, but the machines did at least perform some action other than simply processing or storing data and other information. In the line of cases rejecting processes tied to general-purpose computers or other machines, by contrast, those devices served only to process or store data, not to perform any patentable action. The courts therefore dismissed these devices as insignificant to the patentability analysis.[248]

Simply dismissing computer or other machine limitations in process claims raises its own issues. This kind of focus only on certain individual limitations, rather than on the invention as a whole, falls under what is often called a point-of-novelty approach.[249] This approach focuses on what a court perceives to be the "heart" or gist of an invention, effectively ignoring or at least discounting any other constituent elements.[250] To view printed matter, a law of nature, algorithm, or abstract idea as the main distinguishing element of an invention and then reject the invention as unpatentable on that basis is an example of a point-of-novelty approach.[251] Similarly, discounting data gathering steps, the use of a general-purpose computer, or any other limitation as token, conventional, or obvious and therefore insignificant to the heart of gist of an invention is also a point-of-novelty type of approach.[252]

The problem with point-of-novelty approaches is that they contravene the general rule that an invention must be evaluated as an interconnected whole, with no one limitation given more or less weight than any other.[253] Many patentable inventions, such as the rubber-curing method at issue in *Diamond v. Diehr*, use laws of nature, algorithms, and other unpatentable subject matter to create new and non-obvious combinations of or improvements upon existing

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[248] *See, e.g.*, Bancorp Servs., L.L.C. v. Sun Life Assurance Co., 687 F.3d 1266, 1276-77 (Fed. Cir. 2012) (dismissing use of computers and computer readable media for "repetitive calculations" of life insurance policy values); Fort Props., Inc. v. Am. Master Lease LLC, 671 F.3d 1317, 1323 (Fed. Cir. 2012) (dismissing use of computer to manage real property information); CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1373-77 (Fed Cir. 2011) (dismissing computer-readable medium format of credit card fraud analysis claim); *In re* Grams, 888 F.2d 835, 841 (Fed. Cir. 1989) (dismissing use of computer to analyze clinical test data); *In re* Abele, 684 F.2d 902, 909-10 (C.C.P.A.1982) (allowing claim to "computed tomography apparatus" but disallowing claim to apparatus that merely calculated and displayed data values); *In re* Meyer, 688 F.2d 789, 795-96 (C.C.P.A.1982) (rejecting claim on apparatus programmed to analyze system diagnostic data).

[249] Bernard Chao, *Moderating* Mayo, 107 NW. U. L. REV. 423, 423, 425 (2012); Tun-Jen Chiang, *The Rules and Standards of Patentable Subject Matter*, 2010 WISC. L. REV. 1353, 1412-13.

[250] Chao, *supra* note 249, at 425.

[251] *In re* Gulack, 703 F.2d 1381, 1385 & n.8 (Fed. Cir. 1983); *see generally* Chao, *supra* note 249; Kevin Emerson Collins, *Prometheus Laboratories, Mental Steps, and Printed Matter*, 50 HOUS. L. REV. 391 (2012).

[252] Chao, *supra* note 249, at 439-40; Chiang, *supra* note 249, at 1412-13.

[253] Diamond v. Diehr, 450 U.S. 175, 188-89 (1981); *In re Gulack*, 703 F.2d at 1385 & n.8; *In re* Taner, 681 F.2d 787, 791 (C.C.P.A. 1982); *see also* Chao, *supra* note 249, at 433.

technology. A point-of-novelty approach might nonetheless have disallowed *Diehr*'s method because its point of novelty was the use of the Arrhenius equation, an unpatentable algorithm.[254] Indeed, given that all inventions involve algorithms, laws and phenomena of nature, or abstract ideas to some extent,[255] focusing on such elements as the heart or gist of an invention could lead to all inventions being declared unpatentable.[256] Furthermore, whether or not any particular element of an invention is "conventional," "token," or otherwise insignificant to the heart or gist of invention is perhaps better addressed under the novelty and non-obviousness requirements, not under patentable subject matter.[257]

The point-of-novelty approach nevertheless continues to crop up in patentable subject matter cases, most notably in the Supreme Court's recent decision in *Prometheus*.[258] Even *Diehr* seemed to condone a point-of-novelty type of approach in some circumstances, re-emphasizing that insignificant post-solution activity "will not transform an unpatentable principle into a patentable process."[259] How can courts evaluate inventions as a whole while at the same time discounting some limitations as insignificant and unimportant?

This tension between the point-of-novelty and invention-as-a-whole approaches stems from the fact that artifice and action are not only scalar qualities but also ones whose sufficiency is measured in terms relative to the invention as a whole. While any single element of an invention may clearly possess or lack artifice, the proportion of natural versus human-made and inert versus active elements as well as their respective roles affects whether the invention as a whole displays adequate artifice and action.[260] For example, even though the computer or other device on which information or expression is stored always possesses the same absolute levels of artifice and action (and might otherwise qualify as a machine or a manufacture by itself), in relative terms that device will be considered unpatentable subject matter if it adds little by way of patentable action or artifice to the invention as a whole.

The Federal Circuit's recent decision in *Bancorps Services v. Sun Life*

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[254] *In re* Walter, 618 F.2d 758, 766 (C.C.P.A. 1980); *see also* Chiappetta, *supra* note 34, at 103-04 (noting that on much the same bases, many other patentable inventions would have been unpatentable under the point-of-novelty approach); Mark A. Lemley, *Point of Novelty*, 106 NW. U. L. REV. 1253, 1278 (2011).

[255] *See, e.g.*, *In re* Freeman, 573 F.2d 1237, 1244 (C.C.P.A. 1978); *see also* Chiang, *supra* note 249, at 1412-13 (discussing this objection in other contexts).

[256] *Diehr*, 450 U.S. at 189 & n.12.

[257] *Id.* at 189; *in re Freeman*, 573 F.2d at 1244.

[258] Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1297 (2012).

[259] *Diehr*, 450 U.S. at 191-92 (citing Parker v. Flook, 437 U.S. 584, 590 (1978)); *see also* Chao, *supra* note 249, at 429-430.

[260] *In re* Schrader, 22 F.3d 290, 291 (Fed. Cir. 1994) (noting that some activities are "insufficient to impart patentability"); *accord Fort* Props., Inc. v. Am. Master Lease LLC, 671 F.3d 1317, 1323 (Fed. Cir. 2012).

Assurance Co. nicely illustrates the relativity of artifice and action.[261] *Bancorps* addressed method, system, and medium claims for calculating and managing stable value life insurance policy values.[262] The patentee argued that the computer system and medium claims automatically fell within Section 101 because they covered tangible machines and manufactures.[263]The court rejected this argument, noting that the form of a claim alone does not determine its patentability; a claim's form is effectively just one element of an invention.[264] The gist of *Bancorps*' overall invention, what the court referred to as "the underlying invention," was the calculation and management of policy values.[265] Furthermore, the claimed invention used a computer and computer-readable media only to store information.[266] Computers and computer-readable media assisted only in "the performance of repetitive calculations," and were in fact so immaterial to the method as to be unnecessary.[267] As such, any patentable artifice and action that these devices might have contributed were thus clearly insignificant to the claimed invention as a whole.

THE ARTIFICE-PLUS-ACTION STANDARD APPLIED

As the discussion above has shown, the single common thread implicit throughout patentable subject matter case law is the combination of artifice and action. Although in many ways just another linguistic test, using artifice and action to define patentable subject matter could provide some advantages, particularly in its recognition that it is not bright lines that distinguish patentable from unpatentable subject matter but rather subtle shades of difference. The following Part explains some of the advantages and then briefly describes how artifice and action might be applied to resolve some of the more difficult questions that patentable subject matter doctrine currently faces, such as the patentability of business methods, genetic materials, and computer software.

The Advantages of the Artifice-Plus-Action Standard

Before noting the advantages of using artifice plus action to identify patentable subject matter, this Part acknowledges some of the problems that artifice plus action do not solve.

The most obvious problem, of course, is that the combination of artifice and action explains patentable subject matter cases – except when it does not. At

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[261] Bancorps Servs. v. Sun Life Assurance Co., 687 F.3d 1266 (Fed. Cir. 2012).

[262] *Id.*

[263] *Id.* at 1273.

[264] *Id.* at 1277 (citing, *inter alia*, *Flook*, 437 U.S. at 593).

[265] *Id.* at 1276-77.

[266] *Id.*

[267] *Id.* at 1276-78; *see also, e.g.*, CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1375 (Fed. Cir. 2011) (applying identical analysis to disallow computer and medium claims).

least a fraction of the case law on patentable subject matter has and likely will continue to deviate from, or at best constitute weak examples of, the general pattern of artifice and action. Nonetheless, artifice and action are clearly significant and persistent themes throughout patentable subject matter law and should not be overlooked.

Another problem with artifice and action is that they are not necessarily the most efficient or "correct" way to define patentable subject matter in terms of what will best promote the "Progress of useful Arts." Other, more economically driven ways of defining patentable subject matter may be more effective in terms of distinguishing inventions that would benefit from patent incentives from those that would unduly hinder future innovation.

On the other hand, there is good reason to doubt whether any definition of patentable subject matter – or any other patent law doctrine – can truly optimize the balance between providing incentives without unduly hindering future development. The optimal way to incentivize any given type of technological development is far from clear.[268] And how to apply patentability criteria in a way that most effectively promotes technological progress is perhaps impossible to know without prescience; the best that courts can do is to rely on their intuitions about what patentable technology ought to be.[269]Accordingly, the artifice-plus-action standard stands wholly apart from any economic rationales for why inventions should and should not be patented and advert only to what we do know about how courts actually decide patentable subject matter distinctions. An artifice-plus-action standard for patentable subject matter may not achieve optimal incentives for further innovation, but it is at least a more transparent and direct explanation of what courts have been doing all along.

Although the artifice-plus-action approach may seem like just another effort to "read into the patent laws limitations and conditions which the legislature has not expressed,"[270] some sort of linguistic definition of patentable subject matter is inevitable. The terms "useful Arts" and "technology" are not self-explanatory, and Section 101's categories cannot be interpreted according to their plain and ordinary meanings.[271] Courts often rely instead on historical understandings of these terms, and artifice plus action simply defines in explicit terms what these historical understandings are. Expressly adopting an

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[268] Eisenberg, *supra* note 32, at 49.

[269] Duffy, *supra* note 151, at 619-20. Many have nonetheless written extensively about what patentable subject matter doctrine *should* be, and this Article does not in any way attempt to critique those efforts. *See, e.g.*, Andrew Chin, *Gene Probes as Unpatentable Printed Matter*, 20 FED. CIR. B.J. 527 (2011); Richard S. Gruner, *Better Living Through Software: Promoting Information Processing Advances Through Patent Incentives*, 74 ST. JOHN'S L. REV. 977 (2000); Lemley et al., *supra* note 229; Olson, *supra* note 4; Samuelson, *Benson Revisited*, *supra* note 4.

[270] Bilski v. Kappos, 130 S. Ct. 3218, 3226 (2010) (quoting Diamond v. Diehr, 450 U.S. 175, 182 (1981)).

[271] Parker v. Flook, 437 U.S. 584, 588 (1978).

artifice-plus-action approach to patentable subject matter could therefore foster not only clarity but also predictability and even uniformity in legal treatment of the wide array of technologies that patent law must address.

That being said, a third problem with artifice and action is that they are not bright line rules but rather continuous characteristics that lie along a spectrum. The degree of artifice and action necessary for patentability therefore requires a judgment call that will vary from judge to judge and court to court. Thus, even though applying artifice and action more explicitly will bring some certainty to patentable subject matter, *exactly* how much artifice and action will or will not suffice in any given case is still difficult to predict. The non-economic and non-empirical nature of the assessment further exacerbates the problem. The requisite degree of artifice and action has also varied over time as the liberality of patentable subject matter has varied over time, creating yet further uncertainty.[272]

Patent law frequently must address these kinds of line-drawing exercises. The non-obviousness, utility, enablement, and even written description requirements all lie along a spectrum, forcing courts to make judgment calls about patentability.[273] Patent courts therefore presumably know how to deal with the scalar nature of artifice and action and in fact have long acknowledged that patentable subject matter lies along a spectrum.[274]

Of course, in deciding issues of non-obviousness, utility, enablement, and written description, courts can resort to the "PHOSITA" standard, or what a "Person Having Ordinary Skill In The Art" of the invention might consider obvious, useful, or enabled.[275] Patentable subject matter doctrine, by contrast, does not depend on the PHOSITA standard in judging how much artifice and action is sufficient in any given case.[276] Rather, the gold standards for artifice and action are previously declared patentable and unpatentable subject matter,

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[272] *See* Eisenberg, *supra* note 32, *passim*; Duffy, *supra* note 151, at 614; Morris, *supra* note 40, *Res or Rules*, at 505-08.

[273] *See, e.g.*, Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1608 (2011); Charles W. Adams, *Allocating Patent Rights Between Earlier and Later Invention*, 54 ST. LOUIS L.J. 55, 106 (2009); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, *passim* (2003); Eisenberg, *supra* note 32, at 14.

[274] *E.g.*, Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1298-1300 (2012); *In re* Abele, 684 F.2d 902, 906-07 (C.C.P.A.1982) (noting spectrum between clearly statutory and clearly non-statutory subject matter); *In re* Walter, 618 F.2d 758, 765 (C.C.P.A. 1980) (relying on patentable subject matter "reference points" set in *Flook*); *see also* Christopher A. Brown, *Developments in Intellectual Property Law*, 41 IND. L. REV. 1139, 1148 (2008) (noting patentable subject matter as an "inventive spectrum"); Eisenberg, *supra* note 32, at 14 (". . . Supreme Court precedents on patent law, including its decisions about patentable subject matter, more typically state broad, open-ended principles.").

[275] Burk & Lemley, *supra* note 273, at 1648-51.

[276] *See generally* Magliocca, *supra* note 148 (proposing a PHOSITA-like patentable subject matter standard for processes).

or what courts have referred to as "what is now clearly statutory . . . and what is clearly non-statutory."[277]

All the same, by embracing the scalar nature of both artifice and action, patent law can avoid many of the problems associated with the subject matter inquiry. As explained previously, recognizing that patentable action and artifice are continuous variables allows patentable subject matter doctrine to evaluate an invention as a whole, without having to discount any of its constituent parts. For example, when an invention displays only a token degree of artifice or action, in the form of a computer limitation or data-gathering step, a court currently might have to discount those parts of the invention under a point-of-novelty type of analysis. Under an artifice-plus-action approach, by contrast, the court could acknowledge that the invention as a whole possesses a minimal degree of artifice or action but still reject it as non-statutory subject matter.[278]

Similarly, an artifice-plus-action approach would allow courts to avoid many of the pitfalls to which bright-line rules are often subject. For instance, recognizing that artifice and action are scalar quantities moves patentable subject matter doctrine away from strategic claim drafting.[279] Artifice and action look beyond claim format, "magic words,"[280] or other verbal attempts to disguise non-statutory subject matter as a process, machine, manufacture, or composition of matter. An artifice-plus-action approach focuses not just on the words used to describe a claimed invention but also whether the invention as a whole possesses adequate artifice and action.

This broadening of focus thus obviates the need for the new-machine doctrine, the machine-or-transformation test, the printed-matter doctrine, and other tests that focus more narrowly on category rather than characteristic. Indeed, by focusing on the characteristics of artifice and action rather than on statutory and non-statutory categories, patent law can move away from extensional definitions – definitions of patentable subject matter by example – and toward more intensional definitions – definitions of patentable subject matter by its essential characteristics, artifice and action.[281]

Finally, an approach based on artifice and action allows patentable subject matter to move away from the rigidity of bright-line rules toward the flexibility

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[277] *In re Abele*, 684 F.2d at 906-07 (noting spectrum between clearly statutory and clearly non-statutory subject matter); *accord Prometheus Labs.*, 132 S. Ct. at 1298-1300; *In re Walter*, 618 F.2d at 765; *see also* Brown, *supra* note 274, at 1148.

[278] *But see* Kevin Emerson Collins, Bilski *and the Ambiguity of "An Unpatentable Abstract Idea*, 15 LEWIS & CLARK L. REV. 37, 63 (2011) (suggesting that the claim-as-a-whole approach may not be optimal for certain types of abstract ideas).

[279] *See supra* text accompanying notes 135-138.

[280] Cohen & Lemley, *supra* note 219, at 9 (referring to strategic claiming of software as machines or apparatuses as the "doctrine of magic words").

[281] *Cf.* Jeremy A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1205-06 (2008) (explaining extensional and intensional definitions).

of standards. Bright-line rules provide greater predictability, but patent law by design covers an ever-evolving and unpredictable array of new and inventive technologies. These new technologies present new challenges to definitions of patentable subject matter, and bright-line rules do not adapt well to such challenges.[282] In such unpredictable circumstances, rigid adherence to bright-line rules can produce absurd results, as rules will tend to be both over- and underinclusive.[283] Courts therefore often must graft exceptions onto a rule or otherwise try to change it in order to adapt to unforeseen situations, thereby making the rule more complex, less predictable, and more prone to inconsistent results.[284] This is exactly what happened with the machine-or-transformation test: the courts have had the make exceptions for computer-operated processes that, although technically tied to machines, perform no patentable action.[285] In such situations, standards can actually provide greater certainty than rules.[286] Standards provide less predictability up front but greater flexibility to address uncertain conditions.[287] Given the constantly changing nature of patentable technology, the Supreme Court has often voiced a preference for standards over bright-line rules across a range of patent issues, including patentable subject matter.[288] In the case of the machine-or-transformation test, for example, the Supreme Court rejected the test as a bright-line rule, opting instead for a more flexible approach.[289]

Application to Business Methods, Sports Methods, Diagnostic Methods, Genetics, and Computer Software

To explain how an analysis based on artifice and action might help simplify and clarify patentable subject matter determinations, this Part discusses how artifice and action might resolve the debate over the patentability of business methods, sports methods, diagnostic methods, genetics, and computer software. These categories of invention have been some of the most troubling in terms of whether they qualify as patentable subject matter.

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[282] Chiang, *supra* note 249, *passim*; Duffy, *supra* note 151, at 610-11; Morris, *Res or Rules*, *supra* note 40, *passim*.

[283] Chiang, *supra* note 249, at 1354; Duffy, *supra* note 151, at 626, 631.

[284] *See, e.g.*, Duffy, *supra* note 151, at 633 (describing exceptions developed for "use of a machine" doctrine); *see also generally* Chiang, *supra* note 249, at 1399-1400.

[285] *See supra* text accompanying notes 239-245; *see also* Duffy, *supra* note 151, at 647-48 (noting progressive exceptions to machine-or-transformation test as applied to computer-operated processes).

[286] Duffy, *supra* note 151, at 610 n.1; Carol M. Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577, 609 (1988).

[287] Chiang, *supra* note 249, at 1355; Duffy, *supra* note 151, at 611; Morris, *supra* note 40, *Res or Rules*, at 517-19.

[288] Eisenberg, *supra* note 32, at 14 (providing examples in obviousness, the doctrine of equivalents, the on-sale bar, and so on).

[289] Bilski v. Kappos, 130 S. Ct. 3218, 3227 (2010).

As such, others have analyzed each of these categories in much greater detail and nuance than is possible here. The following discussion is intended to serve only as very brief illustrations of how the artifice-plus-action standard might be applied. More importantly, whether any of these illustrations yields the optimal outcome in terms of what best promotes technological progress is a separate issue about which the following analysis remains agnostic.

Business Methods

The patentability of so-called business methods has become a controversial issue in the last few decades.[290] Previously, most business methods were believed to be categorically unpatentable subject matter.[291] The advent of computers led the financial sector and other business areas to make greater use of information-age technologies, however, and the line between business and technology useful in conducting business began to blur.[292] The Federal Circuit's 1998 decision in *State Street Bank* took an expansive view on the patentability of business methods under the useful, concrete, and tangible test, and for a time, business method patenting flourished.[293]

Public outcry soon followed, however, and the patent system began to rein in business method patenting.[294] In 1999, Congress enacted Section273, establishing prior user rights as a defense to actions for infringement of "method[s] of doing or conducting business."[295] The Federal Circuit rejected the useful, concrete, and tangible test in favor of the machine-or-transformation test in a series of decisions that took a much more strict approach to the patentability of business methods.[296] Most recently, the America Invents Act implemented a transitional program to allow post-grant

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[290] *See generally* John F. Duffy, *Why Business Method Patents?*, 63 STAN. L. REV. 1247 (2011).

[291] *See, e.g.*, State Street Bank & Trust Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998); *see also* Duffy, *supra* note 290, at 1256-57.

[292] *Bilski*, 130 S. Ct. at 3229; *State Street Bank*, 149 F.3d at 1376 n.13; *see also* Duffy, *supra* note 290, *passim*.

[293] Duffy, *supra* note 290, at 1250 (discussing effect of *State Street Bank*); John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987, 991; Leo J. Raskind, *The* State Street Bank *Decision: The Bad Business of Unlimted [sic] Patent Protection for Methods of Doing Business*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 61, 61 (1999).

[294] Duffy, *supra* note 290, at 1250; Allison & Tiller, *supra* note 293, at Part II.

[295] First Inventor Defense Act of 1999, 35 U.S.C. § 273 (2000).

[296] CLS Bank Int'l v. Alice Corp., 717 F.3d 1269, 1292 (Fed. Cir. 2013); Bancorp Servs. v. Sun Life Assurance Co., 687 F.3d 1266, 1277 (Fed. Cir. 2012); DealerTrack, Inc. v. Huber, 674 F.3d 1315, 1317 (Fed. Cir. 2012); Fort Props., Inc. v. Am. Master Lease LLC, 671 F.3d 1317, 1318 (Fed. Cir. 2012); Cybersource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1367 (Fed. Cir. 2011); *In re* Bilski, 545 F.3d 943, 959-60 (Fed. Cir. 2008) (en banc); *see also In re* Comiskey, 554 F.3d 967, 979-80 (Fed. Cir. 2009) (adopting machine-or-transformation without explicitly rejecting useful, concrete, and tangible).

review of patents on methods or apparatuses for "data processing or other operations used in the practice, administration, or management of a financial product or service," on the suspicion that many of the business method patents issued after *State Street Bank* are invalid.[297]

The general discomfort with patenting business methods is clear, although the reasons for it are not. Some critics doubt the validity of business methods patents because of obviousness or anticipation, while others argue that business methods should be unpatentable subject matter generally because business innovations neither need nor benefit from the incentives of the patent system.[298] The Supreme Court in *Bilski v. Kappos* declined to hold business methods categorically unpatentable subject matter and yet expressed its own doubts about the patentability of most business methods.[299]

The Court's equivocation on business methods makes sense under the artifice-plus-action standard. In many cases rejecting business methods as unpatentable – including the Supreme Court's decision in *Bilski* – the methods were dismissed as abstract ideas. These business methods were considered to be simply mathematical algorithms, mental processes or other types of "concepts."[300] The true problem with these methods is not that they were merely naked algorithms, mental steps, or other concepts or "fundamental principles"; each method also employed multiple concrete steps involving

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[297] 157 CONG. REC. S 1367 (Mar. 8, 2011) (statement of Sen. Kyl) (describing transitional program as "reduc[ing] the burden on the courts dealing with the backwash of invalid business method patents"); Leahy-Smith America Invents Act, P.L. 112-29, § 18, 35 U.S.C. §§ 321-329 (2013); *AIA Frequently Asked Questions: Transitional Program for Covered Business Method Patents,* http://www.uspto.gov/aia_implementation/faqs_covered_business_method.jsp (last modified Dec. 11, 2013; *see also* Patent Quality Improvement Act of 2013, S. 866, 113th Cong. § 2 (2) (proposing expansion of transitional program beyond "financial product or service" business methods).

[298] *E.g.*, Allison & Tiller, *supra* note 293, at 992-93; Alan Devlin & Neel Sukhatme, *Self-Realizing Inventions and the Utilitarian Foundation of Patent Law*, 51 WM. & MARY L. REV. 897, *passim* (2009); Eisenberg, *supra* note 32, at 26-27, 52.

[299] Bilski v. Kappos, 130 S. Ct. 3218, 3228-29 (2010) (discussing 35 U.S.C. § 273 but noting that business methods patents "raise special problems" and could "put a chill on creative endeavor and dynamic change").

[300] *E.g.*, *Bilski*, 130 S. Ct. at 3231 (2010) (merely concept of "hedging" against risk); *Alice Corp.*, 717 F.3d at 1275, 1311(Fed. Cir. 2013) (merely concept of "employing neutral intermediaries"); *Bancorp Servs.*, 687 F.3d at 1280 (merely "concept of managing a stable value protected life insurance policy"); DealerTrack, Inc. v. Huber, 674 F.3d 1315, 1333 (Fed. Cir. 2012) (merely "clearinghouse concept"); *Fort Props.*, 671 F.3d at 1322 (merely "conceptual steps" toward tax-free exchanges of real estate); *CyberSource Corp.*, 654 F.3d at 1370-71; *In re* Ferguson, 558 F.3d 1359, 1360, 1366 (Fed. Cir. 2009) (merely "abstract constructs" for marketing method); *In re* Schrader, 22 F.3d 290, 294 (Fed. Cir. 1994); *In re* Meyer, 688 F.2d 789, 796 (C.C.P.A.1982); *In re* Maucorps, 609 F.2d 481, 486 (C.C.P.A.1979).

specific types of data for specific practical ends.[301] The problem with these disallowed business methods is that what limitations they added to the algorithms, mental steps, or other concepts were not of the "inventive" sort[302] – that is to say, those additional limitations did not add sufficient artifice and action to be patentable technology. The common factor in the disallowed business methods is that they comprise only information and instructions for human behavior, neither of which is a form of patentable action.

In *Bilski*, for example, the method at issue consisted primarily of "identifying" (informing) and "initiating transactions" (human activity).[303] Other courts rejected business methods primarily for the informational steps of "calculating;" "determining;" "incorporating language;" "identifying" and "indexing;" "obtaining," and "forwarding" credit report data; "obtaining information" and "constructing a map" of that information.; and "creating," "obtaining," and "adjusting" a shadow credit record.[304] And although many of the business methods involved the use of computers, the computers were used for data processing – i.e., informational purposes – only.[305] To the extent these disallowed methods required any actions, those actions were all human activity, such as "requiring a complainant to submit a request" and "conducting arbitration resolution;" "offering" and "receiving bids;" "developing a shared marketing force" and "obtaining an exclusive right to market;" "aggregating property" and "encumbering the property;" and "instructing" exchange institutions.[306] Although courts have been wary of declaring outright that human activity *per se* is unpatentable subject matter, business methods and other processes that depend primarily on human mental processes or other human activity raise subject matter problems beyond whether the processes constitute abstract ideas.[307] Rejection of processes such as business methods as

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[301] *See, e.g.*, *Bilski*, 130 S. Ct. at 3235, & 3238 n.5 (Stevens, J., concurring); *see also* Eisenberg, *supra* note 32, at 12-13.

[302] *See, e.g.*, Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1294 (2012) (citing Parker v. Flook, 437 U.S. 584, 594 (1978)); *Alice Corp.*, 717 F.3d at 1291.

[303] *Bilski*, 130 S. Ct. at 3223-24.

[304] *Alice Corp.*,717 F.3d at 1287; *Bancorp Servs.*, 687 F.3d at 1279-80; *DealerTrack, Inc.*, 674 F.3d at 1333-34; *CyberSource Corp.*, 654 F.3d at 1370; *In re* Comiskey, 554 F.3d 967, 981 (Fed. Cir. 2009); *In re Schrader*, 22 F.3d at 293-94; *In re Maucorps*, 609 F.2d at 486.

[305] *See, e.g.*, *Alice Corp.*, 717 F.3d at 1287; *Bancorp Servs.*, 687 F.3d at 1276-77; *DealerTrack, Inc.*, 674 F.3d at 1333-34; *CyberSource Corp, Inc.*, 654 F.3d at 1374-75; *Fort Props. Inc.*, 671 F.3d at 1323-24; *In re Maucorps*, 609 F.2d at 486 & n3.

[306] *Alice Corp.*, 717 F.3d at 1286; *Fort Props. Inc.*, 671 F.3d at 1323-24; *In re Ferguson*, 558 F.3d at 1366; *In re Comiskey*, 554 F.3d at 981; *In re Schrader*, 22 F.3d at 293-94.

[307] *Bilski*, 130 S. Ct. at 3238 n.5 (Stevens, J., concurring) (noting excluded categories of subject matter is all "that is left to stand between all conceivable human activity and patent monopolies"); *accord In re* Bilski, 545 F.3d 943, 972 (Fed. Cir. 2008) (en banc) (Dyk, J., concurring). *But see* Interim Guidance for Determining Subject Matter Eligibility for Process Claims in View of Bilski v. Kappos, 75 Fed. Reg. 43922, 43926 (July 27, 2010)

merely instructions for human activity is thus a prime example of how the artifice-plus-action standard defines "technological invention[s]" that "solve[] a technical problem using a technical solution."[308]

One permutation on the business-method debate is presented by a case in which the Supreme Court will hear oral arguments as this Article is going to press. *Alice Corp. v. CLS Bank International* involves a claimed invention that is in many ways almost identical to the one at issue in the Supreme Court's earlier decision in *Bilski v. Kappos*. Both cases involve: business methods for hedging risk during business transactions; intermediary institutions in hedging against that risk; and most importantly, exchanges of information about the transactions and parties to those transactions.[309] In both cases, an *en banc* Federal Circuit rejected the claimed inventions as unpatentable subject matter.[310] These results comport perfectly with the artifice-plus-action standard, since both cases involve what is primarily just human activity and information about that activity, with little or no patentable action or artifice.[311] The only real difference between *Bilski* and *Alice Corp.* is the fact that the latter tied its business methods to computers and computer-readable media in so-called "system" and "Beauregard" medium claims.[312] The question presented to the Court in *Alice Corp.* thus specifically addresses the effect of incorporating computer technology on the patentability of Alice Corp.'s claims.[313]

It is always risky to prognosticate when it comes to pending Supreme Court cases, but if history is any indication, the Supreme Court may likely reject Alice Corp.'s claims despite their computer ties. As Judge Lourie noted in his concurrence in the Federal Circuit's *en banc* opinion, the computer-related limitations add nothing and are merely incidental to Alice Corp.'s claimed business method, which was itself just the "'disembodied' concept" of reducing risk through the use of an intermediary.[314] Computerizing this otherwise unpatentable method served only for calculation, storage, and

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(describing "human behavior" and "instructing on 'how a business should be conducted'" as unpatentable "general concepts").

[308] *See, e.g., AIA Frequently Asked Questions*, *supra* note 297 (distinguishing "covered business methods" from "technological inventions" not covered by the transition program).

[309] *Compare Alice Corp.*, 717 F.3d at 1274, *with Bilski*, 130 S. Ct. at 3223-24, *and In re* Bilski, 545 F.3d 943, 950-51 (Fed. Cir. 2008).

[310] *Alice Corp.*, 717 F.3d at 1273 (deciding per curiam); *In re* Bilski, 545 F.3d at 950-51; *see also Bilski*, 130 S. Ct. at 3229-30 (affirming Federal Circuit decision).

[311] *See also supra* text accompanying notes 303-308.

[312] *Alice Corp.*, 717 F.3d at 1287-88. "System" claims are essentially methods combined with the tangible devices used to perform them. *Id.* at 1289. "Beauregard" claims recite the use of computer-readable media to store computer software. *Id.* at 1287-88; *see also infra* text accompanying notes 381-383 (discussing *Beauregard* claiming).

[313] Brief for the United States as Amicus Curiae in Support of Respondents, Alice Corp. v. CLS Bank Int'l, 134 S. Ct. 734 (2013) (No. 13-298).

[314] *Alice Corp.*, 717 F.3d at 1287, 1288.

communication of information – in other words, the system and medium claims fail to provide any "inventive concept" in the form of patentable action.[315] Despite its limitation to computer implementation, Alice Corp.'s business method is not "inventive" and does not add sufficient artifice and action to be patentable technology.[316]

Sports Methods

Unlike business methods, sports methods have not been the subject of litigation or other challenges to their validity.[317] Sports methods have, however, been the subject of scholarly attention, most of which has been critical.[318]

Sports methods often represent new ways of using known athletic equipment, such as novel ways of swinging golf putters, exercising with wrist straps, and playing football.[319] Sports methods are therefore presumably as patentable as any other method of use. Nonetheless, critics object to sports method patents because ideally, success in sports depends on human skill rather than technology.[320] The importance of the human elements in sports and the inevitable variation in human skill may lead to problems of enablement or claim definiteness, and the competitive nature of sports would seem to call for a level playing field, not patent exclusivity.[321]

Enablement, claim definiteness, and other patentability requirements aside, the importance of the human element in sports leads to the concern that sports methods are not "technological" enough to be patentable.[322] Thus, like business methods, sports methods may often involve equipment or other apparatuses, but unless those apparatuses contribute significant artifice and

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[315] *Id.* at 1290-91.

[316] *Id.* at 1291; *see also* Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1294 (2012) (citing Parker v. Flook, 437 U.S. 584, 594 (1978)).

[317] Neeraj Arora, *Disabling Patentability for Skill-Based Inventions: Aligning Patent Law with Competition Policy*, 22 SANTA CLARA COMPUTER & HIGH TECH. L. REV. 1, 37-38 (2005).

[318] *See e.g.*, Derek Bambaurer, *Legal Responses to the Challenges of Sports Patents*, 18 HARV. J. LAW & TECH. 401(2005); Proloy K. Das, Note, *Offensive Protection: The Potential Application of intellectual Property Law to Scripted Sports Plays*, 75 IND. L.J. 1073, 1080 & nn.42-43 (2000); Giuliana R. Garcia, 11 U. DENV. SPORTS & ENT. L.J. 81 (2011); Mark Walsh, *Patently Ridiculous?*, N.J. L.J., Aug. 26, 1996, at A5.

[319] U.S. Patent No. 6,712,720 (filed Mar. 11, 2002) (issued Mar. 20, 2004); U.S. Patent No. 5,616,089 (filed Mar. 29, 1996) (issued Apr. 1, 1997); U.S. Patent No. 4,323,232 (filed Sep. 26, 1977) (issued Apr. 6, 1982); U.S. Patent No. 4,911,443 (filed Dec. 28, 1988) (issued Mar. 27, 1990); Arora, *supra* note 317, at 38.

[320] Arora, *supra* note 317, at 38; Kukkonen, *supra* note 148, at 823.

[321] Arora, *supra* note 317; Bambaurer, *supra* note 318, at 423-24; Garcia, *supra* note 318; Kukkonen, *supra* note 148, at 823.

[322] Lemley et al., *supra* note 229, at 1346.

action to the invention, those methods are non-statutory subject matter.[323] The more a particular sports method depends on human performance, the less artifice and action it displays and the less patentable it is. Again, human skill is a means to invention but not invention itself.[324]

Diagnostic Methods

A third type of process that involves significant informational content coupled with significant human involvement is diagnostic methods. Usually involving medical diagnoses, this category of methods correlates an observable data pattern with a diagnosis of what typically causes the pattern. Not surprisingly, courts have rejected diagnostic methods as laws of nature and mental processes.[325] The fundamentally informational character of these diagnostic methods is undeniable. As explained above, laws of nature and mental processes are both forms of information, and correlations based on laws of nature are informational as well. Indeed, diagnoses themselves are forms of information, as are the data on which diagnoses are based. Any "data gathering" steps incidental to these methods fail to overcome the informational nature of diagnostic methods.[326]

That is not to say that methods or apparatuses for measuring or collecting diagnostic data are all unpatentable subject matter, particularly if those methods or apparatuses perform some patentable action in obtaining such diagnostic data. For example, in *Arrhythmia Research Technology, Inc. v. Corazonix Corp.*, the court found a method and apparatus for measuring cardiac electrical impulses to be patentable subject matter because both converted naturally occurring cardiac electrical impulses into machine-analyzable electrocardiograph signals in order to measure the impulses.[327] Claims to diagnostic methods that do not include steps involving meaningful degrees of patentable action, by contrast, are not patentable subject matter.[328]

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[323] *Cf.* SiRF Tech., Inc. v. Int'l Trade Comm'n, 601 F.3d 1319, 1333 (Fed. Cir. 2010) (requiring machine limitation to "play a significant part in permitting the claimed method to be performed" to confer patent eligibility).

[324] *Interim Guidance*, *supra* note 307 (describing "human behavior such as exercising, wearing clothing, following rules or instructions" as "general concepts").

[325] Mayo Collaborative Servs. v. Prometheus Labs., 132 S. Ct. 1289, 1294 (2012); Lab. Corp. v. Metabolite Labs., Inc., 548 U.S. 124, 126-27 (2006); *Myriad I*, 689 F.3d 1303, 1334 (Fed. Cir. 2012); *In re* Meyer, 688 F.2d 789, 796 (C.C.P.A. 1982).

[326] *Prometheus Labs.*, 132 S. Ct. at 1297-98; *Myriad I*, 689 F.3d at 1335; *In re Meyer*, 688 F.2d at 795-96.

[327] Arrhythmia Research Tech., Inc. v. Corazonic Corp., 958 F.2d 1053, 1059 (Fed. Cir. 1992); *see also In re* Abele, 684 F.2d 902, 908-09 (C.C.P.A. 1982) (allowing claims to computed tomography method that involved scanning); *In re Meyer*, 688 F.2d at 796 (noting method contained only mathematical algorithm and no additional physical elements or process steps).

[328] *Prometheus Labs.*, 132 S. Ct. at 1298; *Myriad I*, 689 F.3d at 1334.

Genetics

Another challenging category of innovation is genetics, the subject of the Supreme Court's recent decision in *Association for Molecular Pathology v. Myriad Genetics, Inc.*[329]

Genes code for the synthesis of proteins, which in turn serve as structural materials and catalysts for a variety of cellular processes. Genetics research has become an increasingly important area of research and development due to its centrality in biological processes.[330] Because genes are the primary units of heredity, they provide information on disease risks, biological relatedness between individuals, populations, and species, and even evolutionary patterns.[331] The value of genetic material thus lies in not only its informational content but also in the fact that this information is a catalog of naturally occurring phenomena.[332]

Genes do more than just inform; they are highly complex chemicals that interact with a range of intracellular components.[333] Researchers have isolated and manipulated genetic materials to take advantage of their chemical and structural properties as binding sites for antibodies, to use them as probes, primers, and markers for measuring genetic expression, and for chromosome mapping, artificially synthesizing genes, and controlling protein expression.[334]

Genetic materials thus raise difficult issues under the artifice-plus-action standard. On the one hand, genetic materials are derived from nature and indeed are valued because of their naturally occurring informational content. From this perspective, genetic materials would seem to fail both artifice and action. On the other hand, genetic materials must be isolated from their natural state in order to be sequenced or used in ways that are chemically and mechanically useful.[335]

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[329] *Myriad II*, 133 S. Ct. 2107 (2013).

[330] *See, e.g.*, *Myriad I*, 689 F.3d at 1310; *In re* Deuel, 51 F.3d 1552, 1554-56 (Fed. Cir. 1995); Amgen, Inc. v. Chugai Pharm. Co., Ltd., 927 F.2d 1200, 1207-08 (Fed. Cir. 1991); *In re* O'Farrell, 853 F.2d 894, 895-99 (Fed. Cir. 1988); Eileen M. Kane, *Splitting the Gene: DNA Patents and the Genetic Code*, 71 TENN. L. REV. 707, 708 (2004).

[331] *Myriad I*, 689 F.3d at 1310; Andrew Bowman, *Genes 101: Are Human Genes Patentable Subject Matter?*, 18 RICH. J.L. & TECH. 15, 30 (2012); John J. Doll, *The Patenting of DNA*, 280 SCIENCE 689, 690 (1998).

[332] *See, e.g.*, *Myriad II*, 133 S.Ct. at 2112; Chin, *supra* note 269, *passim*; Collins, *Semiotics 101*, *supra* note 45, at 1389; Rebecca S. Eisenberg, *Re-Examining the Role of Patents in Appropriating the Value of DNA Sequences*, 49 EMORY L.J. 783, 786-87 (2000); Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827, 836 (1999).

[333] *Amgen*, 927 F.2d at 1206 ("A gene is a chemical compound, albeit a complex one."); Eisenberg, *Re-Examining the Role of Patents*, *supra* note 332, at 784-86.

[334] *See, e.g.*, *Myriad I*, 689 F.3d at 1310; *In re* Fisher, 421 F.3d 1365, 1368 (Fed. Cir. 2005). Note that not all of these activities meet the utility requirement, but they do all demonstrate patentable action. *Id.* at 1370-78.

[335] *See, e.g.*, *Myriad I*, 689 F.3d at 1328-33.

For the most part, both the PTO and the courts appear to have taken the latter view – that isolated genetic materials are patentable subject matter.[336] This view is seemingly not based on any case law directly addressing the question. Rather, the patent system seems to have assumed that DNA is patentable based on case law addressing issues other than patentable subject matter.[337] Whether isolation modifies naturally occurring DNA enough – that is, whether isolated DNA possesses adequate artifice and action – therefore remains a question to be answered.

Because of the informational content of genetic materials, moreover, their patentability is more than just a question of isolation and comparison to other examples of purified materials. Genetic materials come in a wide range of forms, including genomic deoxyribonucleic acid (DNA, or what most people think of as genes), messenger ribonucleic acid (mRNA), transfer RNA, ribosomal RNA, mitochondrial DNA, and even artificial nucleic acid analogs, such as peptide nucleic acids.[338] Deciding whether any particular type of genetic material possesses adequate artifice and action therefore can require extremely fine line-drawing.

For the sake of brevity, this discussion will focus on just a few genetic material forms. *Myriad* involved three types of claims: isolated full-length genes, isolated fifteen-nucleotide gene fragments ("oligonucleotides"), and isolated complementary DNA ("cDNA").[339] The *Myriad* Court held the cDNA form to be statutory subject matter but rejected both the isolated genes and oligonucleotides as unpatentable.[340]

The Court's discussion of cDNA was surprisingly brief, suggesting that the Court found this genetic form to be relatively non-controversial.[341] Complimentary DNA is formed in the laboratory by creating DNA-versions of naturally occurring mRNA produced during the gene transcription. Transcription is the process in which a gene is used as a stencil to produce mRNA copies.[342]

Messenger RNA differs from genomic DNA in one important aspect. Most genomic DNA contains large percentages of "nonsense" sequences, or introns,

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[336] Eisenberg, *Re-Examining the Role of Patents*, *supra* note 332, at 785-86; Conley & Makowski, *supra* note 20, at Pt.IV.A.

[337] Intervet, Inc. v. Merial Ltd., 617 F.3d 1282, 1293 (Fed. Cir. 2010) (Dyk, J., concurring in part); Stephen W. Chen et al., *Patent Protection in Medicine and Biotechnology: An Overview*, 4 J. HEALTH & LIFE SCI. L. 106, 128 (2011).

[338] *See, e.g.*, U.S. Patent No. 5,747,282 (filed Jun. 7, 1995) (issued May 5, 1998) (describing dependent claims including "isolated DNA . . . which contains BRCA1 regulatory sequences").

[339] *Myriad I*, 689 F.3d at 1340 (Moore, J., concurring in part).

[340] *Myriad II*, 133 S. Ct. 2107, 2117, 2119 (2013).

[341] *See id.* at 2119; *see also* Kane, *supra* note 330, at 741 (noting cDNA usually held to be statutory subject matter).

[342] *Myriad I*, 689 F.3d at 1310-14.

that are never expressed in protein synthesis.[343] During mRNA processing in the cell, these introns are excised, leaving the mRNA with only the expressed sequences, or exons.[344] Thus, while mRNAs are molecules naturally produced during the transcription process, cDNA copies of that mRNA – i.e., DNA versions of genes containing exons only – do not occur in nature, a point that the *Myriad* Court seemed to find dispositive.[345]

What the Court's brief discussion of cDNA did not address, however, is whether cDNA and the native DNA to which it responds are marked differently, in function as well as in structure. Complementary DNA is valuable in large part because its informational content – its sequence of nucleotides – is identical to both its naturally occurring mRNA and exonic native DNA counterparts; it is this identity that makes cDNA useful in gene sequencing, medical diagnosis and other information-intensive applications.[346]

Nonetheless, cDNA is also valuable for its unique physical properties, which make cDNA functional in ways that its natural counterparts are not. Genes are not just biological information and templates for copying that information; they are also means for transferring information, much like a compact disk.[347] Because cDNA carries its genetic information in a way that is different from either mRNA or native DNA, cDNA is often more effective in introducing new genetic material to transform cells, in probing cellular genomes, in performing directed gene deletions, and in measuring gene expression.[348] Although the *Myriad* Court did not directly address these differences in native DNA and cDNA function, they would seem to be more than adequate in terms of artifice and action, particularly when combined with the structural differences on which the *Myriad* Court focused.

By contrast, the *Myriad* Court found isolated DNA to be much more problematic.[349] A rather generic term, isolated DNA can refer to a variety of genetic forms, including naturally occurring genes or gene fragments extracted directly from a cell, lab-created copies of such genes, and even cDNA.[350]

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[343] *Id.*

[344] *Myriad II*, 133 S. Ct. at 2111; Gregory Dolin, *Exclusivity Without Patents: The New Frontier of FDA Regulation for Genetic Materials*, 98 IOWA L. REV. 1399, 1414 (2013).

[345] *Myriad II*, 133 S. Ct. at 2117 (2013); *Myriad I*, 689 F.3d at 1326. The Court noted that retroviruses do produce cDNA copies of their own RNA, but the odds of naturally occurring retroviral cDNA ever being identical in sequence to the BRCA1 or 2 cDNA are infinitesimally small. *Myriad II*, 133 S. Ct. at 2119 n.8; *Myriad I*, 689 F.3d at 1356 n.5 (Bryson, J., concurring in part and dissenting in part).

[346] *Myriad I*, 689 F.3d at 1340 (Moore, J., concurring in part); *see also* Kane, *supra* note 330, at 723, 742. Messenger RNA and cDNA use different bases (uracil instead of thymine, respectively), but in informational content, the two bases are interchangeable.

[347] *Myriad I*, 689 F.3d at 1340.

[348] *Id.* at 1340-41 (Moore, J., concurring in part). *But see id.* at 1330 (suggesting that patent eligibility looks only at structural, not functional, differences).

[349] *Myriad II*, 133 S. Ct. at 2116-19.

[350] *E.g.*, *Myriad I*, 689 F.3d at 1326, 1328.

Myriad's patents, however, make clear that the term "isolated DNA" included DNA with "intervening sequences," thus distinguishing isolated DNA more generally from cDNA, which contains no such intervening sequences.[351] As a result, Myriad's claims to isolated DNA were broad enough to cover DNA that is structurally almost identical to native DNA.

That is not to say that isolated DNA is not modified at all; before the Supreme Court addressed *Myriad,* the Federal Circuit pointed out in its majority opinion that the mere process of extracting native DNA entails not only mechanical separation from its chromosome but also chemical alterations to cleave the bonds between the extracted segment and the rest of the genome.[352] Myriad's patent claims also covered laboratory-synthesized copies of isolated DNA sequences, a factor that would seem to suggest artifice.[353] Unlike the case with cDNA, however, the degree of structural identity between even "synthetic" versions of isolated DNA and their native DNA counterparts is so high that they possess insufficient artifice for patentability.

The *Myriad* Court also seemed to view isolated DNA as possessing insufficient action, although the Court's views on this matter are arguably too narrow. The Court described isolated DNA as if it were valuable solely for its informational content, noting that Myriad claimed its isolated DNA not by its chemical structure but rather by its informational content – i.e., by the polypeptide sequences for which that DNA coded.[354]

Isolated DNA can serve significant non-informational functions as well, however. For example, Myriad argued that DNA must be isolated in order to be used as probes, primers, and a variety of other useful functions. [355] Isolated DNA containing introns can perform better than cDNA in transforming certain types of animal cells.[356] Furthermore, isolated genes can contain a number of regulatory sequences, such as promoters, enhancers, and operators, which serve not as information but as binding sites that control gene expression.[357] Thus, much like cDNA, isolated DNA would seem to offer adequate patentable action. Regardless of whether they display adequate action, however, the fact remains that isolated DNA sequences do not display adequate artifice to be

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[351] *See, e.g.*, U.S. Patent No. 5,747,282 (filed June 7, 1995).

[352] *Myriad I,* 689 F.3d at 1328-29; Utility Examination Guidelines, *supra* note 51.

[353] *See, e.g.*, '282 Patent.

[354] *Myriad II*, 133 S. Ct. at 2118.

[355] *See, e.g.*, Transcript of Oral Argument at 46, *Myriad II*, 133 S. Ct. 2107 (2013) (No. 12-398). The claim language at issue in *Myriad*, however, was not limited to isolated DNA in its tagged (and therefore more modified and functional) form. *Myriad I,* 689 F.3d at 1309.

[356] Dolin, *supra* note 344, at 1415-16.

[357] JEREMY W. DALE ET AL., FROM GENES TO GENOMES: CONCEPTS AND APPLICATIONS OF DNA TECHNOLOGY 14 (3d ed. 2012); Andrew W. Torrance, *Biology & Genetics: Gene Concepts, Gene Talk, and Gene Patents*, 11 MINN. J.L. SCI. & TECH. 157, 170 (2010). Claim differentiation shows, however, that *Myriad*'s use of the term "isolated DNA" does not include these regulatory elements. *See, e.g.*, '282 Patent (adding dependent claims including "isolated DNA . . . which contains BRCA1 regulatory sequences.").

patentable.[358]

The Court's opinion does not address oligonucleotides directly but strongly suggests that in some ways they are simply a subset of isolated DNA. Because Myriad's oligonucleotide claims were also broad enough to cover both intron and exon fragments, moreover, the oligonucleotide claims could include short cDNA sequences. The Court clearly viewed both types of oligonucleotide sequences as unpatentable, presumably because of their structural near-identity with their native DNA counterparts.

Unlike Judge Moore's concurrence in the Federal Circuit's decision in the case, the Court never discussed whether oligonucleotides possess patentable action. As Judge Moore noted, oligonucleotides offer "a variety of applications and uses" that neither native nor isolated DNA possesses.[359]

Furthermore, unlike either cDNA or gene-length isolated DNA, oligonucleotides are much less valuable for their informational content.[360] DNA fragments from both expressed and non-expressed regions can be used to detect single-nucleotide polymorphisms ("SNPs"), which are genetic variations among individuals signifying ancestry, relatedness, gene mutations, and other markers.[361] Identifying SNPs is a largely informative enterprise, but DNA fragments can also be used for more non-informative purposes, including duplication of DNA sequences, DNA vaccination against viruses and bacteria, gene mapping, and blocking gene expression.[362] Again, to say that oligonucleotides possess adequate action does not resolve the issue, and the *Myriad* Court clearly viewed oligonucleotides as possessing inadequate artifice to be patentable.

Computer Software: Patenting computer software is a controversial issue, with many scholars and jurists criticizing software patents as low quality, unnecessary, ambiguous, and prone to litigation.[363] Computers and, by logical extension, computer software are widely regarded as "technological," but much computer technology is "information technology;" that is, the storage, retrieval, transmission, and manipulation of data.[364] Again, if a computer program or other innovation primarily functions to manipulate data or other

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[358] *Myriad II,* 133 S. Ct. at 2117.

[359] *Myriad I,* 689 F.3d 1303, 1341 (Fed. Cir. 2012) (Moore, J., concurring in part).

[361] Doll, *supra* note 331, at 689-90; Pui-Yan Kwok & Xiangning Chen, *Detection of Single Nucleotide Polymorphisms*, 5 CURRENT ISSUES MOLECULAR BIOLOGY 43, 43 (2003).

[362] Doll, *supra* note 331, at 689; Dolin, *supra* note 344, at 1415; Kwok & Chen, *supra* note 361, at 44; Yu, *supra* note 55, at 667.

[363] *See generally*, JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE 187-214 (2009); James Bessen & Michael J. Meurer, *Lessons for Patent Policy from Empirical Research on Patent Litigation*, 9 LEWIS & CLARK L. REV. 1, 16 (2005); *see also* Chao, *supra* note 243, at 424-25, 434 (citing critics of software patenting).

[364] A DICTIONARY OF PHYSICS (John Daintith ed., 6th ed. 2009); *see also* AT&T Corp. v. Excel Commc'ns, Inc., 172 F.3d 1352, 1356 (Fed. Cir. 1999).

information, it is often dismissed as an unpatentable mental process, algorithm, or abstract idea.[365]

The problem with computer software involves more than just whether it directs a computer to do something other than store or manipulate information, however. A higher-order concern is whether software, regardless of what it directs a computer to accomplish, is itself just information or expression. Software comprises what it essentially signs, symbols, and words used to instruct computer function and, indeed, on this basis is often considered to be copyrightable as a literary work.[366] Outside of informing computer function, however, software itself performs no function and serves no purpose. Some early court decisions accordingly disallowed software claims under the printed-matter doctrine.[367]

The printed-matter doctrine does not adequately address the complexity of computer software, however. The Federal Circuit has held that the printed-matter doctrine applies only to printed characters intelligible to humans, not to computers or other machines.[368] The distinction between computer-readable and human-readable writings leaves much to be desired, as computer software can be legible to both humans and machines, while other computer-readable files, such as digitized novels, are clearly not patentable "technology."[369] Nonetheless, the Federal Circuit's refusal to apply the printed matter-doctrine to software exemplifies courts' general disinclination to reject all computer software as unpatentable subject matter.[370] This discomfort stems from the fact that software is not just printed characters or descriptive matter; software can also be functional in enabling a computer to perform new tasks. Computer software is therefore not a comfortable fit for either copyright or patent protection.[371] In some respects, software is just data and expression and therefore inert, but in other respects, software effectively becomes a part of computer and its functionality.[372] The patent system has therefore struggled with whether software is patentable subject matter and what guidelines to use

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[365] *See supra* text accompanying note 248.

[366] *See* Chiappetta, *supra* note 34, at 141-42.

[367] *See, e.g.*, Burk, *supra* note 34, at 141-42 (discussing *In re* Jones, 373 F.2d 1007 (C.C.P.A. 1967)).

[368] *In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994) (quoting *In re* Bernhart, 417 F.2d 1395, 1399 (C.C.P.A. 1969)).

[369] *See* Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1243, 1249 (3d Cir. 1983); Collins, *Semiotics 101, supra* note 45, at 1390-92; *see also* MANUAL OF PATENT EXAMINING PROCEDURE, *supra* note 131, at § 2106.01.

[370] *See also* Bilski v. Kappos, 130 S. Ct. 3218, 3228 (2010); Gottschalk v. Benson, 409 U.S. 63, 72-73 (1972).

[371] *See generally* Chiappetta, *supra* note 34; Karjala, *Distinguishing Patent, supra* note 35; Pamela Samuelson, *Why Copyright Law Excludes Systems and Processes from the Scope of Its Protection*, 85 TEX. L. REV. 1921 (2007).

[372] Chiappetta, *supra* note 34, at 95.

in making that decision.[373]

Consistent with the artifice-plus-action standard, the trend in software patenting is to limit patentability to software that does more than simply calculate, compute or display information or expression.[374] Taking a cue from courts' general approach to processes claimed as machines, patentability would seem to require that both the software and the machine on which it operates be part of an overall invention that possesses sufficient patentable action.[375] For example, on one end of the spectrum is *Gottschalk v. Benson*, in which the Supreme Court rejected as unpatentable a method of programming a general-purpose digital computer to convert signals from binary-coded decimal form into pure binary form. The Court held that such a program accomplished nothing other than calculating a mathematical algorithm and as such performed no patentable function.[376] On the other end of the spectrum is *Diamond v. Diehr*, in which the Court upheld the patentability of a rubber curing process that used a programmed digital computer .[377] Although what distinguished the process over the prior art was the incorporation of a computer program for constantly calculating the proper cure time for the rubber, the Court held that the overall invention was "a *physical* and *chemical* process for *molding* precision synthetic rubber products" and therefore patentable subject matter.[378] The digital computer program was only a small part of the overall invention in *Diehr*, but it was a meaningful part that improved the overall process.[379] In between the two extremes set by *Benson* and *Diehr* are other cases involving software, including *Parker v. Flook*, which looked like more than just a naked mathematical algorithm but nonetheless overall did nothing more than provide an alarm limit number. That is, *Flook*'s invention performed little or no patentable action.[380]

To be entirely consistent with the artifice-plus-action standard, software that is not a meaningful part of an otherwise patentably active invention should not be patentable. For example, software is often claimed as embodied in a storage

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[373] Diamond v. Diehr, 450 U.S. 175, 219 (1981) (Stevens, J., dissenting) ("[T]he cases considering the patentability of program-related inventions do not establish rules that enable a conscientious patent lawyer to determine with a fair degree of accuracy which, if any, program-related inventions will be patentable.").

[374] Parker v. Flook, 437 U.S. 584, 595 (1978) (quoting *In re* Richman, 563 F.2d 1026, 1030 (1977)); Bancorp Servs. v. Sun Life Assurance Co., 687 F.3d 1266, 1278 (Fed. Cir. 2012) (citing SiRF Tech., Inc. v. Int'l Trade Comm'n, 601 F.3d 1319, 1333 (Fed. Cir. 2010)).

[375] *See supra* text accompanying notes 247-267.

[376] Gotttschalk v. Benson, 409 U.S. 63, 71 (1972).

[377] *Diehr*, 450 U.S. 175 (1981).

[378] *Id.* at 184 (emphasis added).

[379] *Id.* at 177-78.

[380] Parker v. Flook, 437 U.S. 584, 585, 589-90 (1978).

medium under what is known as a *Beauregard* claim.[381] A floppy diskette, computer memory chip, or other medium itself is often separately patentable, but simply adding software to the medium may not change the function of the medium in any patentably novel way. Likewise, the storage medium may not perform the recited function of the software in any patentably active way.[382] In these cases the printed-matter doctrine may not apply to exclude the *Beauregard* claim as unpatentable subject matter, but the shortcomings are very similar: in neither case does the stored content bear any meaningful relationship to its storage medium.[383]

Of course, to say that software is patentable subject matter when it serves as an integral part of a patentably active invention as a whole is not to say that all software warrants patent protection or that software patenting might not hinder more progress than it promotes.[384] Again, some commentators argue that software patents are overly broad and ambiguous because software is often claimed functionally and not limited to any particular code.[385] Like gene patents, however, much of the criticisms of software patenting could perhaps be addressed by tightening the application of definiteness and the other patentability requirements[386] or by employing other measures that ease the potentially restrictive effects of software patents.[387]

CONCLUSION

"Technology" seems like a simple term that everyone understands, at least according to its everyday usage. What technology means when it comes to patentable subject matter, however, is a question that has been debated

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[381] CyberSource Corp. v. Retail Decisions, Inc., 654 F.3d 1366, 1375 (Fed Cir. 2011). The *Beauregard* claim is named after the very brief opinion in *In re Beauregard,* 53 F.3d 1583 (Fed. Cir. 1995), in which the Federal Circuit seemed just to sign off on the PTO's decision to accept such claims. CyberSource Corp., 654 F.3d at 1373; *see generally* John R. Thomas, *Of Text, Technique, and the Tangible: Drafting Patent Claims Around Patent Rules*, 17 J. MARSHALL J. COMPUTER & INFO. L. 219, 244-46 (1998) (discussing *Beauregard* claims).

[382] *CyberSource Corp.*, 654 F.3d at 1375; Thomas, *supra* note 381, at 271-72.

[383] *See* Chiapetta, *supra* note 34, at 147 & n.63; *cf.* Cohen & Lemley, *supra* note 219, at 10 n.23 (criticizing new-machine doctrine by noting that merely adding new content to existing devices is not necessarily patentable invention).

[384] *See, e.g.*, Robert P. Merges, *Software and Patent Scope: A Report from the Middle Innings*, 85 TEX. L. REV. 1627, 1633 (2007) (finding no evidence that patenting has hurt the software industry); Stuart J. H. Graham & David C. Mowery, *Software Patents: Good News or Bad News?*, in INTELLECTUAL PROPERTY RIGHTS IN FRONTIER INDUSTRIES: SOFTWARE AND BIOTECHNOLOGY (ROBERT HAHN ED. 2005).

[385] *See generally* Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905 (2013).

[386] BESSEN & MEURER, *supra* note 363, at 187-214.

[387] Cohen & Lemley, *supra* note 219, *passim* (advocating minor doctrinal changes to ensure patents are enforceable without becoming overbroad).

throughout patent law's history. Despite the complexity and confusion in courts' repeated attempts to define patentable subject matter, there are two surprisingly consistent concepts that define the vast majority of patentable subject matter – the concepts of artifice and action.

Artifice is the quality of being created by humans, not by nature. Action is the quality of actively behaving or operating. Together, artifice plus action explain and, perhaps more importantly, unify the law on patentable subject matter. The artifice-plus-action standard is not an economically driven one, nor is it a standard that necessarily promotes "Progress in useful Arts," but it is nonetheless remarkably consistent across time and across courts. An artifice-plus-action standard may therefore bring greater transparency and clarity to patentable subject matter doctrine.